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SOLID STATE ELECTRO-OPTIC COLOR FILTER AND IRIS

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FINAL REPORT

DECEMBER 1974 THROUGH JUNE 1975

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JOHNSON SPACE CENTER
HOUSTON, TEXAS

UNDER CONTRACT NO. NAS 9-13549

RCA

RCA GOVERNMENT AND COMMERCIAL SYSTEMS
ASTRO-ELECTRONICS DIVISION PRINCETON, NEW JERSEY

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PREFACE

This is the final report on the progress of the project "Solid State Electro-Optic Color Filter and Iris," being performed by the Astro-Electronics Division of RCA for the Johnson Space Center of the National Aeronautics and Space Administration under Contract NAS 9-13549. Wafer polishing, electrode deposition, and color filter analysis tasks were performed by the RCA Laboratories. The report covers work performed from December 1974 through June 1975, and responds to the documentation requirements set forth in Article I-34, Items 4 and 5 of the contract.

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SECTION I

INTRODUCTION AND SUMMARY

The Astro-Electronics Division (AED) of RCA submits to NASA this Final engineering study report covering the third phase of Solid State Electro-Optic Filter (SSEF) development under Contract No. NAS 9-13549.

The objectives and requirements of this third phase, which were all successfully accomplished, are identified as follows:

1) Design and fabricate a pair of SSEF's in a binocular holder for evaluation of field sequential stereo TV applications.

2) Design and fabricate the electronic circuitry for use with the stereo goggles. Self-contained circuitry (power supply, switching, and timing) is included, requiring only an external video input.

3) Design and fabricate a polarizing screen suitable for attachment to various size TV monitors for use in conjunction with the stereo goggles.

4) Fabricate an improved Engineering Model #2 filter using the bonded holder technique developed during Phase II, and integrate this filter to a GCTA color TV camera.

5) Fabricate and assemble an engineering model color filter using PLZT control elements.

Technical discussion and description of each of the above items is contained in Section II.

The first phase of the contract covered performance evaluation of the electro-optic properties of PLZT ferroelectric ceramic material when utilized as a variable density and/or spectral filter in conjunction with a television scanning system. (PLZT is an acronym for a homogenous solid solution of lead zirconate and lead titanate, modified with lanthanum oxide.)

Theory of operation and general performance measurements are contained in the first engineering study report (AED R-4013F) issued May 31, 1974.

The second phase of the contract placed primary emphasis on the development of techniques and procedures for processing the PLZT disks and for applying efficient electrode structures. A number of samples were processed using different combinations of cleaning, electrode material, and deposition process. Best overall performance resulted from the direct evaporation of gold over chrome electrodes. Successful samples were produced for use in an experimental measurement program.

In addition, a ruggedized mounting holder assembly was designed, fabricated and tested. The assembly provides electrical

contacts, high voltage protection, and support for the fragile PLZT disk, and also permits mounting and optical alignment of the associated polarizers.

Detailed descriptions of the Phase II activity and results are contained in the Second Engineering Study Report (AED R-4064) issued December 18, 1974.

SECTION II

TECHNICAL DISCUSSION

A. STEREO GOGGLES

The basic PLZT mounting holder assembly previously developed was used as the starting point for the design of the stereo goggles. The design objective was to attain a lightweight, versatile unit which could be worn by persons with or without regular glasses.

A formed and welded aluminum frame was designed to mount the two PLZT holders. Details of the frame and headset assembly are shown in RCA drawing SK 2284585 (all referenced drawings are contained in Appendix A). Plastic straps join the frame to a padded headband assembly. A double articulated arrangement is provided at the straps to permit tilt angle and level adjustment to suit individual viewers. In addition, two attachment holes in the plastic straps provide for fore-aft adjustment. Figure 1 shows the assembled headset, while Figure 2 shows them in use for stereo-TV viewing in a laboratory environment.

The PLZT holder assemblies contain an integral polarizer on the viewers side. The TV monitor side (outer) is comprised of a clear glass plate, thus the viewer experiences minimal effect on normal vision while wearing the headset, even though the electronic switching is activated.

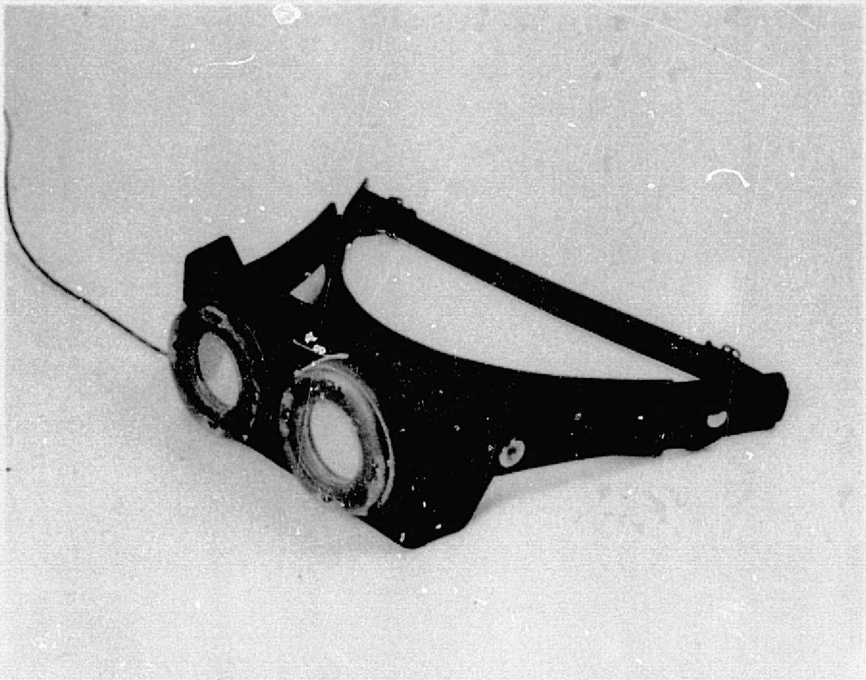


Figure 1. Photograph of Stereo Headset

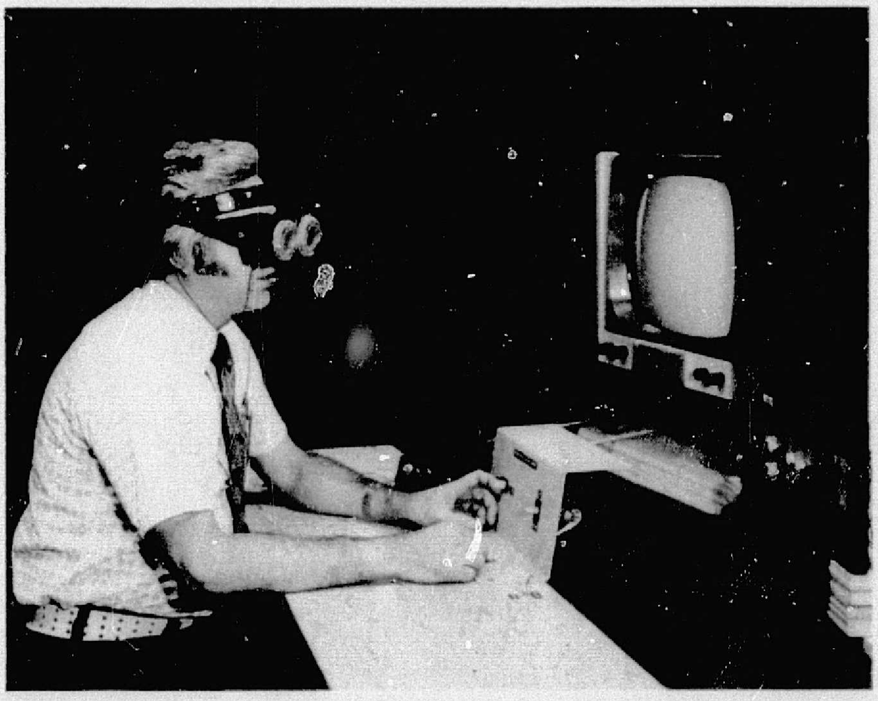


Figure 2. Stereo Headset In Use for Viewing

The polarization axis of the TV monitor screen has been arbitrarily defined as horizontal; therefore, the headset polarizers are mounted with their axis vertical, while the PLZT electrodes are at a 45° angle to the horizontally polarized screen.

A single multi-conductor shielded cable is used to connect the stereo headset assembly to the associated switching electronics.

For those readers not familiar with the operation of stereo television using PLZT switches, Section II-B describes the basic technique. Further discussion may be found in NASA Technical Brief No. B74-10223.

B. STEREOSCOPIC TELEVISION OPERATION

Existing stereoscopic television systems have used various means for displaying the third dimension. Differences lie primarily in the viewing concept; all rely on similar binocular camera techniques which may employ dual cameras or a single camera with an optical splitter. Displays have generally taken the form of adjacent images, with image separation maintained through polarizers, or anaglyph filters worn by the viewer.

These viewing systems distort the viewers vision when he looks away from the television display to perform other functions. Reflective hood systems suffer from image fusion time, and view position constraints. A field-sequential stereo television system using a pair of PLZT light gates for solid-state switching

of the visual path overcomes these problems.[1] Standard television equipment may be used with little additional equipment to produce the stereoscopic system. The system may be used in space exploration and habitation operations such as rendezvous and docking of space vehicles, remote instrumentation control, and remote gathering of visual data.

Figure 3 shows the system configuration. Two cameras are shown for convenience of illustration; a single camera can also be employed with an electro-optic shuttering system. The scene is viewed by the left and right cameras, separated by the normal interocular distance and yawed to provide the desired convergence angle.

The video output signals from camera LC and camera RC represent the left eye view and the right eye view of the object, respectively, as sensed in stereoscopic perspective. These signals are time division multiplexed on a field basis by a synchronized multiplexer with, for example, the odd-field signal of camera LC sampled alternately with the even-field signal of camera RC. The video output signal from the multiplexer is a sequence of odd-field signals from LC alternating with even-field signals from RC. These correspond to a sequence of alternating left eye and right eye stereoscopic views of the object. In all other respects, the multiplexed video output signal is similar to the composite signal of either camera, and is fully compatible with other television require-

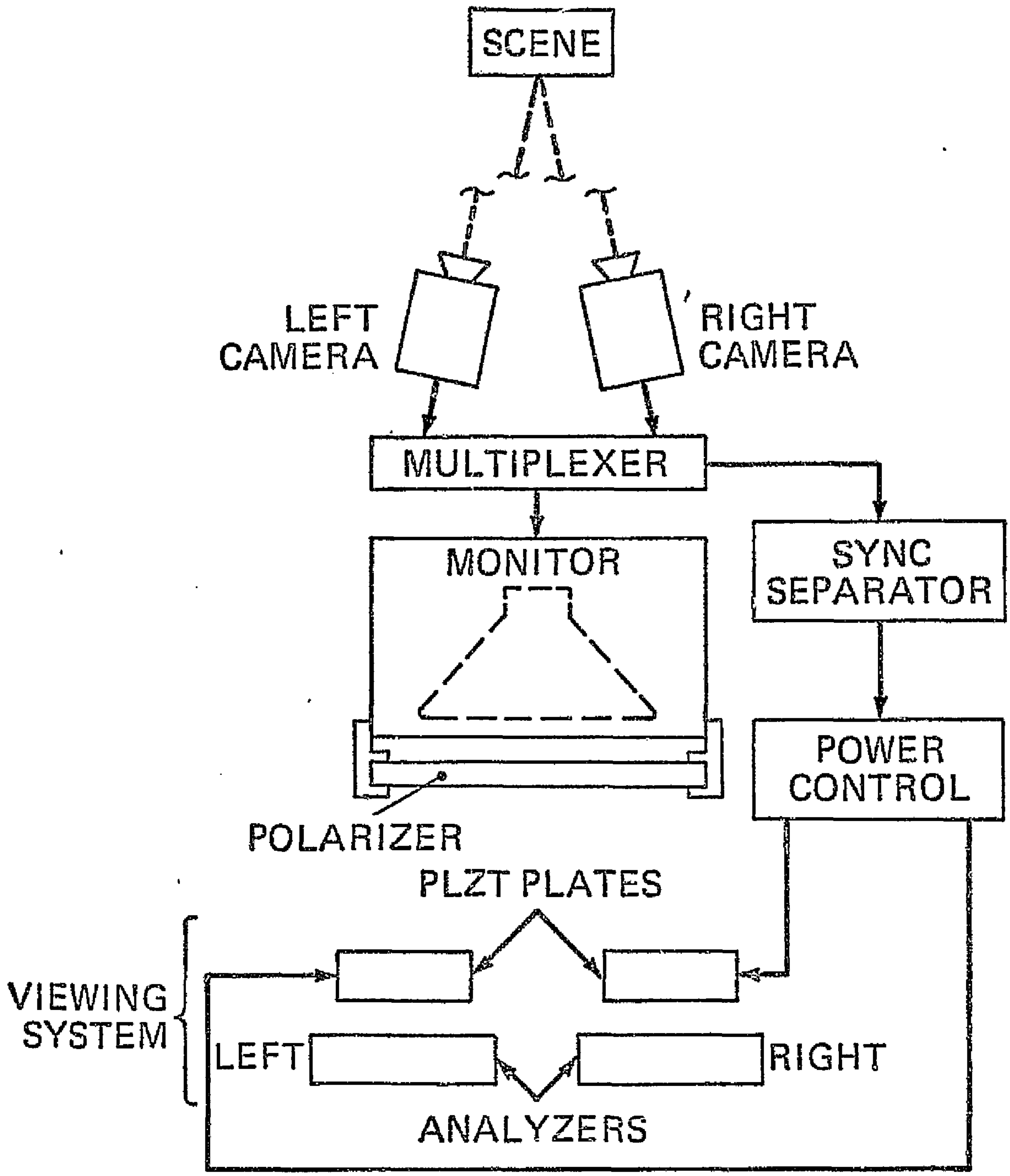


Figure 3. Stereo System Configuration

ments. The multiplexer is transmitted to a standard television monitor with attached polarizing screen, where the left and right images of the object are alternately displayed at a 60 Hz broadcast rate.

The viewing system uses a pair of PLZT plates and associated analyzers as ON/OFF filters in a pair of goggles worn by the viewer (Figure 2). The filters are actuated alternately, in synchronism with the displayed video, by the power control circuit. In this manner, first one eye of the viewer sees the screen of the monitor while the other eye is blocked, then the other eye sees the screen while the first eye is blocked.

The control circuit is triggered by the sync separator which detects the odd/even field information and accordingly triggers the power control to enable the left-eye optical path ON when the displayed image is from the left camera. Similar triggering of the power control occurs for the signals from the right camera. As a result, the viewer's left eye sees, in rapid sequence, left-camera images, and the right eye sees right-camera images. The switching of the views occurs rapidly enough, with otherwise-standard television components, so that normal persistence of vision leaves the viewer with the impression of continuous screen image exposure for each eye. Thus the viewer experiences a true stereoscopic reproduction of the object. Since the transmission of the PLZT filter is optically neutral, the system may be used to reproduce both color and monochrome

stereoscopic images. Since the viewer's goggles include only electro-optic elements and analyzers, he experiences only minor visual degradation when looking away from the monitor. The analyzer in this case blocks that part of the ambient light that is naturally polarized perpendicular to the polarization axis of the analyzer. This effect will be the same as a light shade of polarized sun glasses and adequate light will always pass through to the viewer's eyes in these situations.

The viewing system is particularly advantageous in cases where the viewer must observe both the monitor and other controls in performance of some task. For example, an astronaut piloting a spacecraft which is to rendezvous and dock with another space vehicle may view a three dimensional televised view of the docking structure and also be able to observe internal gauges and controls required in piloting the craft.

The multiplexer function can be implemented using a conventional special effects generator operating in a vertical split field mode. By using a V/2 trigger rate, the vertical split will alternately select full vertical fields of video.

C. STEREO GOGGLE ELECTRONICS

The objective of the electronics design was to develop the circuits required to switch or "shutter" a pair of PLZT elements at a field sequential broadcast TV rate (60 Hz). This would then permit stereo viewing of field sequential stereo information on a single screen display.

The individual PLZT wafers represent a reactive load with a capacity of about 0.015 µfd. To switch 700 volts across the wafers requires a maximum energy of $\frac{CV^2}{2} = 3.68 \times 10^{-3}$ watt-seconds. Battery operation is required to provide portability and minimize the external interfaces; however an efficient circuit design is needed to maintain low power consumption and extend battery life.

Several methods were reviewed for possible use. The first method would utilize a locked oscillator driving a step-up transformer to provide the required voltage. This technique was determined to be excessively lossy, requiring peak battery currents of 1.0 ampere.

A second method considered was to slowly charge a capacitor during the active field time, and then discharge this capacitor into the primary of a pulse transformer to charge the PLZT during the vertical blanking interval. Assuming we charge the capacitor to 10 volts, the required capacitor value is

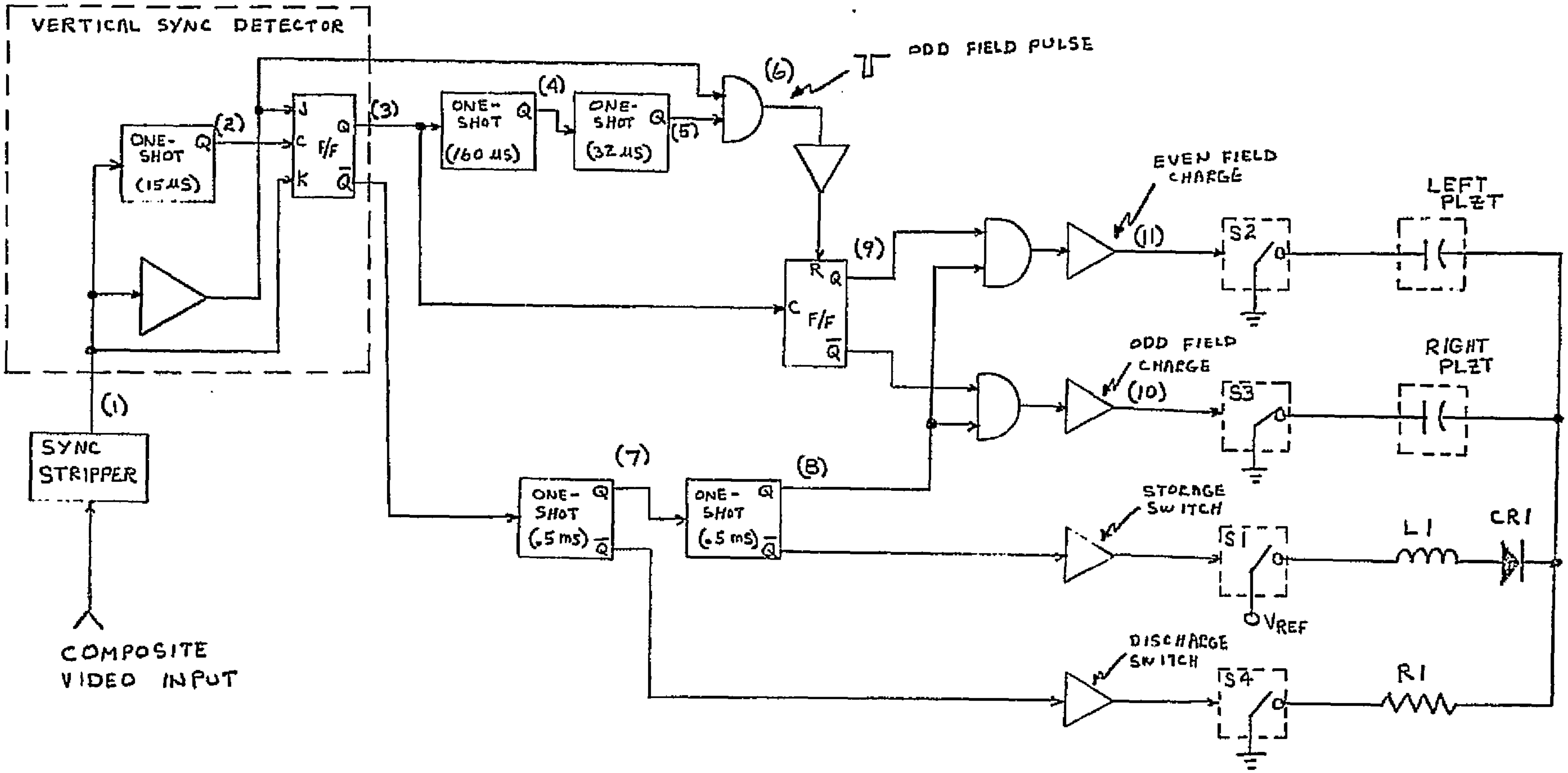
$$C = \frac{2 \times 3.68 \times 10^{-3}}{10^2} = 74 \text{ microfarads.}$$

Obtaining stable value capacitors in this capacity range is difficult. Reducing the capacitor size would require significantly higher input voltage to be achieved with an inverter (and attendant losses).

The third technique considered is to utilize an inductor to transfer energy, by establishing a current through the inductor during the active field time and transferring the current to the PLZT during the vertical blanking interval. Assuming an inductor of 1.0 henry is used, the peak current required is $I = 2 \times 3.68 \times 10^{-3} = 86$ milliamperes, with the transfer time being one-fourth the period of the natural ringing frequency, or approximately 0.2 millisecond.

Based on the design advantages, the third technique was selected for implementation. The block diagram (Figure 4) shows the details of synchronizing with the incoming video signal and transferring energy to the PLZT wafer, while the associated timing diagrams are shown in Figure 5. Transistor switches S1 through S4 are enabled during the vertical blanking interval. S4 discharges the PLZT element during the first half of the interval. Charging is accomplished by closing S1 in conjunction with S2 or S3 (for left or right channel selection) during the second half of the interval. CR1 disconnects the charging path after full potential is reached.

The sync stripper removes video information from the composite input waveform, and is followed by a vertical sync detector. A window of 1/2 H is opened following the sixth equalizing pulse after vertical sync, and nanded with the composite sync information to produce a horizontal sync pulse indicating an odd field. (An odd field is defined as follows: if there is



NOTE:
NUMBERS IN PARENS REFER
TO TIMING DIAGRAM (FIG. 5)

Figure 4. Stereo Electronics Block Diagram

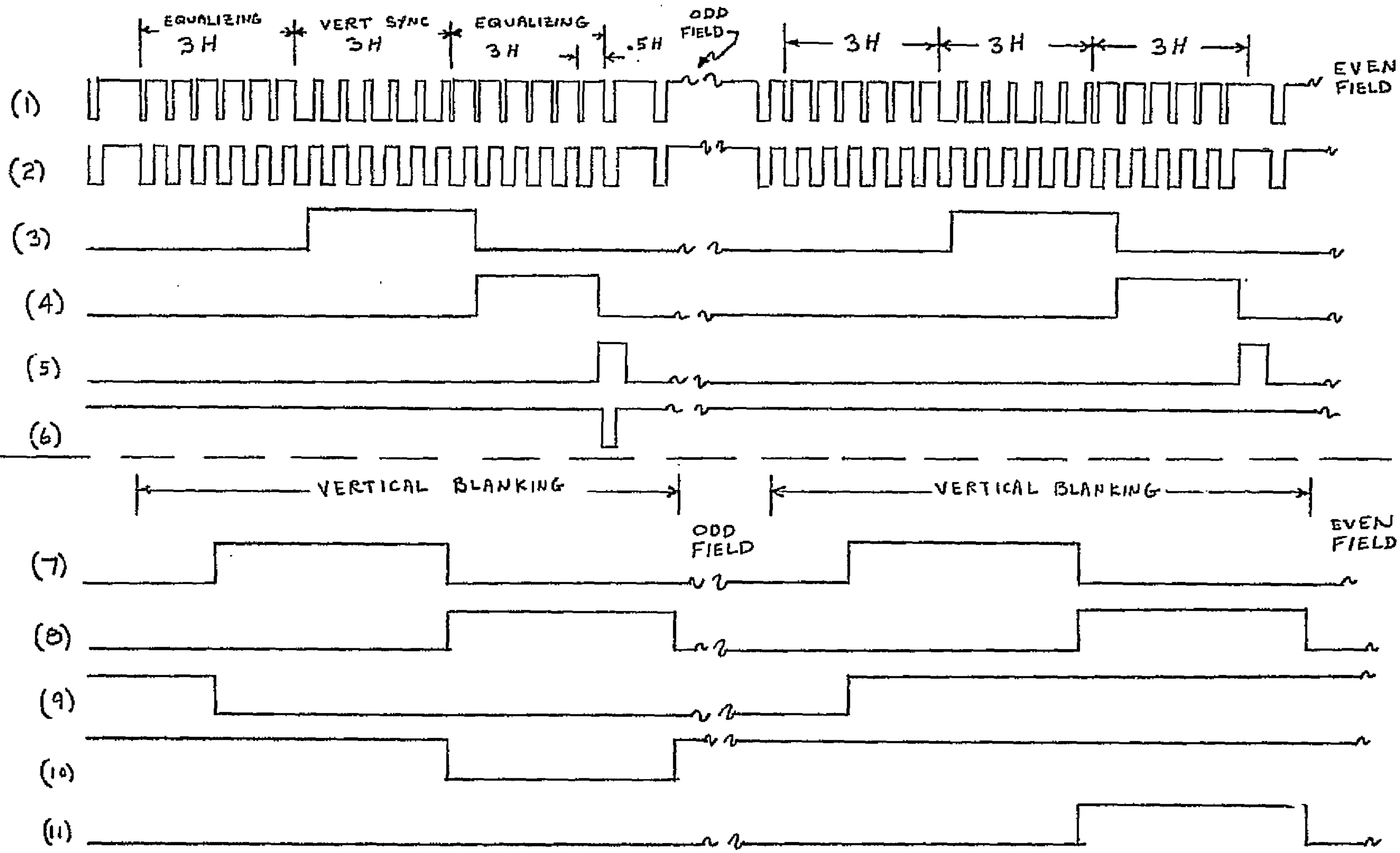


Figure 5. Stereo Timing Waveforms

$\frac{1}{2}$ H delay to the first horizontal sync pulse after the end of vertical sync, the following field is odd). The odd field indicator is used to synchronize the PLZT left/right switching with the associated camera switching.

A one-shot of 0.5 millisecond is triggered from the leading edge of vertical sync and used to discharge the PLZT's to a uniform starting potential through switch S4. The trailing edge of this pulse is used to trigger a second one-shot which charges the PLZT wafer through S1. Selection of the left or right channel is performed by activating S2 or S3 as required. A reversing switch is also provided to interchange the left/right channel selection to accommodate non-standard input presentation.

The logic circuits are implemented with low-power CMOS devices, permitting the entire power control system to operate on less than 0.5 watt of power. Three mercury batteries provide the required +6.75 and -13.5 volt potentials. Operating time for a single set of batteries is approximately 20 hours. A switch and a connector are included to permit use with an external power supply. The electronics are packaged in a small box (2" x 3-3/4" x 6-1/4", 5 x 9.5 x 16 cm) with an integral clip designed to be attached to the users belt.

The schematic, board assembly drawings, and parts list for the electronics are contained in Appendix A.

D. POLARIZING FILTER ASSEMBLY

A polarizing filter assembly for attachment to the face of a TV monitor was designed using an aluminum frame. A clear screen area of 12.5" x 15.5" (32 cm x 40 cm) is provided, with the polarization axis horizontal. Adjustable clamps are provided at the four corners of the frame to permit clamping to a monitor case height between 12" (30 cm) and 15.5" (40 cm). The clamps also contain adjustable feet to permit depth adjustment in the attachment. The clamp arm is designed unsymmetrical, but with symmetrical mounting holes so that it may be used in two positions. Knurled thumbscrews secure the clamps in place after adjustment.

A rabbet groove in the inner face of one-half of the frame members clamps the plastic polarizing sheet in position. The assembly is supplied with a Polacoat polarizing sheet installed. This material has a crossed polarizer attenuation of 106:1. An additional sheet of Polaroid HN-32 polarizer is also supplied for experiments which may require greater insertion attenuation. This material has a crossed polarizer attenuation of 2000:1.

The polarizing screen details are shown in the following RCA drawings:

SK 2288064-501	Polarizing Filter Assembly
SK 2288065-1,2,3,4	Polarizing Filter Frame
SK 2282706-1,2,3	Polarizing Filter Clamps

E. ELECTRO-OPTIC COLOR FILTER OPERATION

1. General

Theoretical considerations of color filters designed to use the PLZT electro-optic effect are described in detail in the First Interim Technical Report and in Monthly Report No. 5. Additional design constraints are described in Section II-H of the Second Interim Technical Report. During Phase III of the current program, an operating model of the two-stage optical network system was constructed and tested to verify the theoretical calculations.

The general configuration is briefly described in the following paragraphs. Further details are provided in the above referenced documents.

2. Spectral Filter Operation

The intensity I transmitted by a birefringent plate between parallel polars is given by:

$$I = I_o B \cos^2 \pi (n_1 - n_2) t \bar{\nu} \qquad (1)$$

where $\bar{\nu}$ is the wave number (the reciprocal of the vacuum wavelength of the light, proportional to the optical frequency), I_o is the incident intensity, B is a factor that is essentially independent of $\bar{\nu}$, n_1 and n_2 are the refractive indices for the two orthogonal polarizations in the medium, and t is the

thickness of the plate. The intensity I, plotted as a function of $\bar{\nu}$, represents the spectral response function of the array, and can be made to have a maximum at any desired wave number $\bar{\nu}_o$ if the thickness or the birefringence of the plate are adjusted so that:

$$(n_1-n_2)\ t = m/\bar{\nu}_o \tag{2}$$

where m is any integer. The value of m used to make an array with a transmission maximum at $\bar{\nu}_o$ is called the <u>order</u> of the filter. Filters with large values of m have the desirable property that their transmission decreases rapidly as $\bar{\nu}$ departs from $\bar{\nu}_o$. However, they suffer from the drawback that the adjacent maxima are more closely spaced than with filters with lower orders. The colors produced by simple filters of this sort are actually quite different from pure spectral colors. When attempting to approximate the visible spectral hues with a simple filter whose value of $\bar{\nu}_o$ can be "tuned" over the range of visible wavelengths, the best subjective impression is obtained with a filter having parallel polars and $m = 2$. For $m = 1$ the transmission peak is too broad and for $m = 3$ and higher the adjacent transmission peaks in the visible produce unsaturated colors. The colors produced by an $m = 2$ filter represent the visible spectrum fairly well, with the exception that a satisfactory green is not obtained.

It is possible to make filters whose transmission decreases rapidly as $\bar{\nu}$ departs from $\bar{\nu}_o$, without degradation from closely-spaced adjacent maxima, if more than one birefringent element is employed. Arrays of many parallel polarizers, interspersed by birefringent plates whose retardations increase in a powers-of-two series, have been used as monochromatizing filters with a very narrow spectral passband.[2] The presence of many polarizers will introduce excessive losses. Narrow passband filters have been described[3] that utilize a multiplicity of birefringent plates and as few as two polars.

A filter that closely approaches any specified spectral response can be produced by incorporating a sufficient number of birefringent plates between two polars. Optical network synthesis techniques can provide a wide variety of spectral responses using a number of identical birefringent plates.[4] If the birefringence of each plate in the network is changed by the same amount, then the shape of the spectral response function is retained but the periodicity is changed, so that the positions of the transmission peaks are shifted. Provided the spectral bandwidth and insertion loss can be reasonably low, such a tunable filter can replace the rotating color wheel in a field-sequential TV system, by shifting the birefringence during the vertical blanking interval. Review of a number of synthesized networks shows that a system with two identical active plates provides a close approximation to the desired response, and has a response given as:

$$I = \frac{I_0}{9} \left[3 + 4 \cos 2\pi \ (n_1 - n_2) \ t \ \bar{\nu} + 2 \cos 4\pi \ (n_1 - n_2) \ t \ \bar{\nu} \right] \qquad (3)$$

This function has the narrowest principal peak that is allowed for a two-plate filter, but is not as free of subsidiary maxima as are other allowed functions.

Figure 6 shows the spectral response for the synthesized two-stage network, compared to a single stage second order filter. The basic two-stage configuration and optic angles are shown in Figure 7. Each plate is required to shift 520 nm, with an initial bias (which can be provided by a passive retarder) of 830 nm.

3. Network Filter Implementation

To demonstrate the performance of the two-stage optical network color filter, each of the required elements was obtained, mounted, and assembled on a fabricated "optical bench". Figure 8 shows a disassembled representation of each of the constituent elements. The required delta retardation range for each stage is provided by a pair of PLZT plates to reduce the total required voltage swing. The initial retardation offset required is achieved using passive plastic plates (Reference 5, page 47).

Examining the configuration, Element No. 1 is a conventional polarizing plate, with its polarization axis set at an angle of 135° to the horizontal plane. Element No. 2 is a full wave

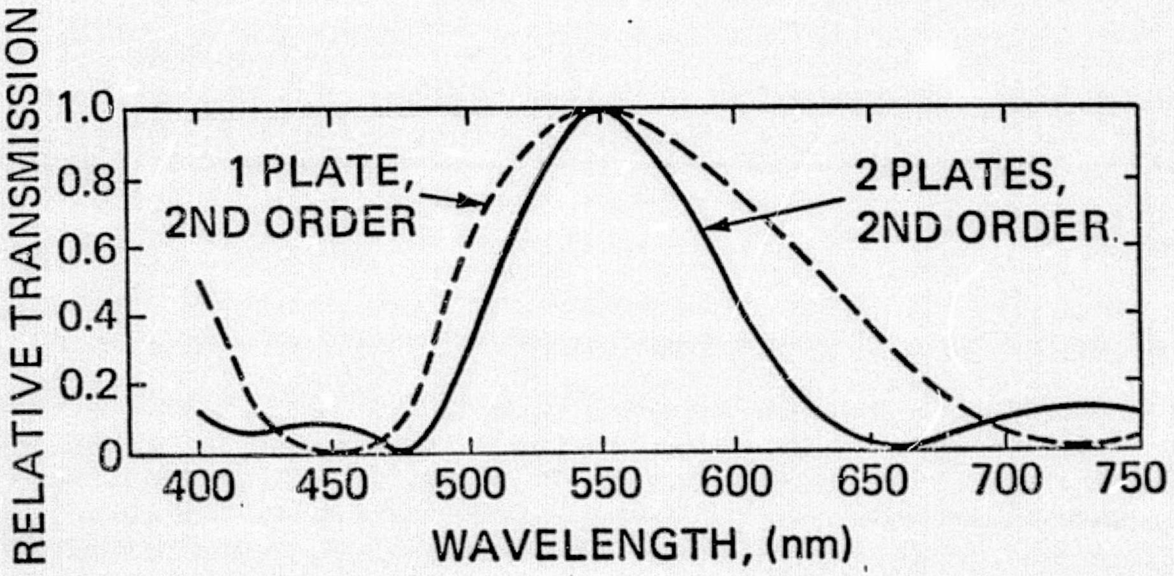


Figure 6. Spectral Response, Network vs. Single Stage Filter

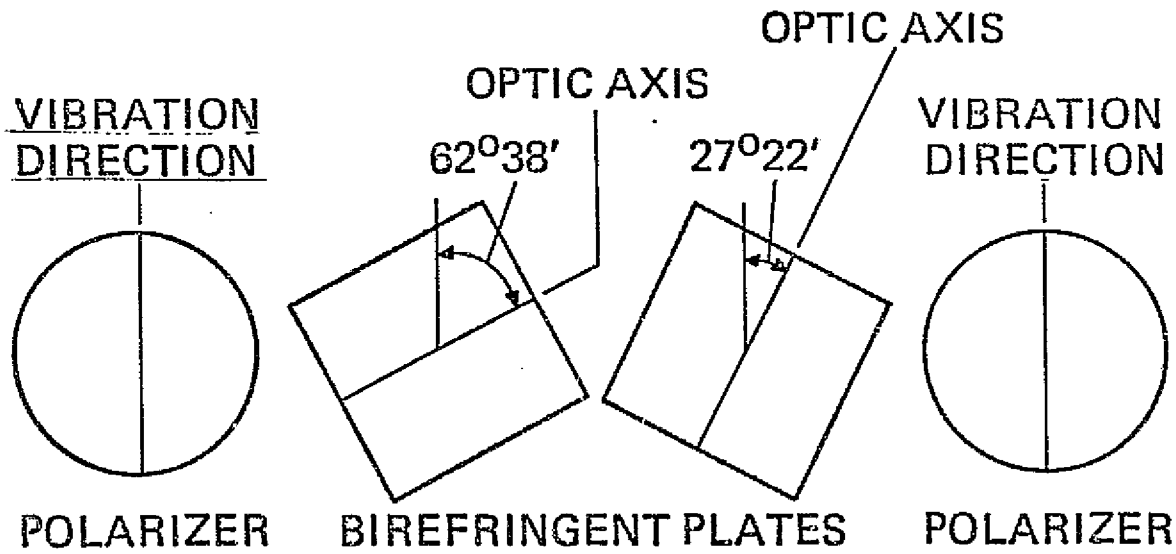


Figure 7.   Basic Network Configuration

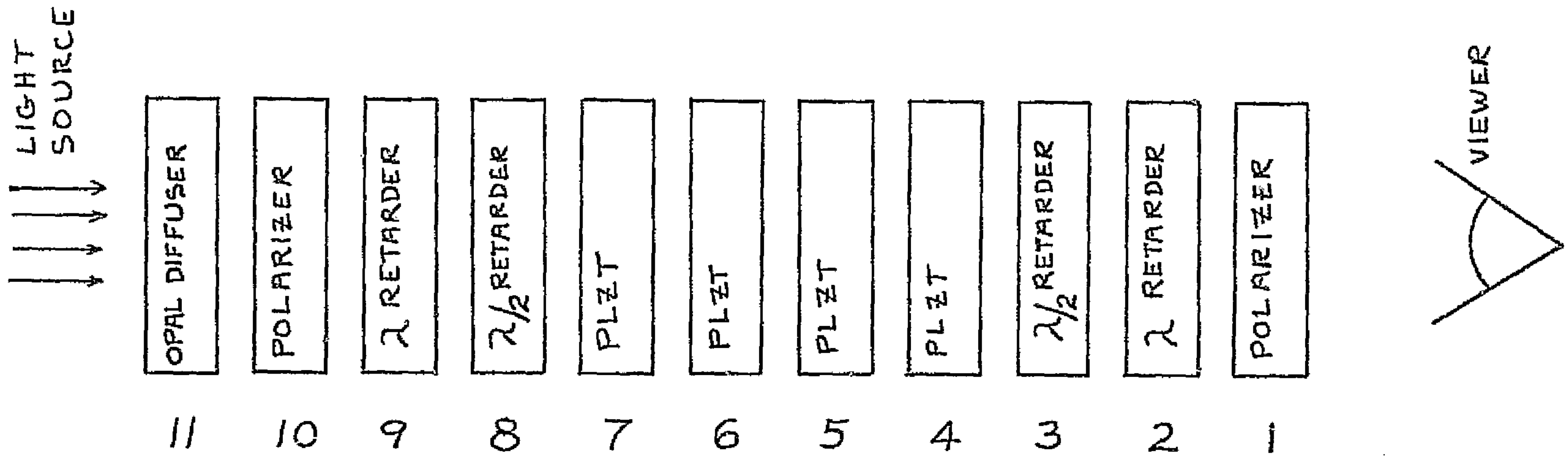


Figure 8. Two-Stage Network Filter Element Configurations

retardation plate (Oriel No. 2756, Γ = 560 nm) whose fast axis is set at 90° to the electrode fingers on the subsequent PLZT plate (Element No. 4). Element No. 3 is a half-wave retardation plate (Oriel No. 2754A, Γ = 280 nm) with its fast axis similarly set.

Element No. 4 is a PLZT wafer (S/N 20) mounted in a rotatable holder. The electrode finger, or slow axis, is adjusted to an angle of 163° to the horizontal. Element No. 5 is a PLZT wafer (S/N 19) in a similar holder, at the same angle as Element No.3. Elements 1 through 5 comprise the first stage of the network.

Elements No. 6 and No. 7 (PLZT wafers S/N 17 and 12) are mounted with their slow axis at an angle of 17° to the horizontal. Elements No. 8 and No. 9 are half-wave and full-wave retarders respectively (Oriel No. 2754 and 2756A). Their fast axis is set at 90° to the slow axis of Elements No. 6 and No. 7. Element No. 10 is a second conventional polarizer whose polarization axis is at an angle of 135° to the horizontal plane (parallel to the first polarizer). Elements 6 through 10 comprise the second stage of the two-stage network.

Element No. 11 is an opal glass diffusing plate, used to provide a diffuse viewing object when illuminated by a microscope lamp or similar source.

Calibration alignment marks are provided on each of the optical elements to permit easy adjustment to their proscribed position, while the adjustable holders permit experimentation with other configurations. Figure 9 shows a photograph of the assembled filter system, with the elements adjusted to their normal configuration. Electrode voltages are applied through individual 100 megohm protection resistors mounted in an external box.

The relative transmission characteristics for the cascaded network were calculated for six values of nominal wavelength throughout the visible spectrum. These characteristics are plotted in Figures 10 through 15, together with the equivalent transmission of a single-stage second order filter. The improved spectral separation available with the network is obvious from the curves; however it can also be seen that the network configuration contains considerable blue contamination when set to the red pass (λ_o = 650 nm) position.

Subjective evaluation of the network filter performance indicates quite good results when compared to earlier single filter observations. Overall uniformity of color across the observed plate area is excellent. Color purity is considered to be good, although the predicted contamination of red is noticeable. Color positive transparencies were taken of the observed filter output. Color prints of the transparencies are shown in Figure 16a through 16f. Degradation of the color quality occurred in the printing process (positive to negative to print); however, the color uniformity is quite evident in these figures.

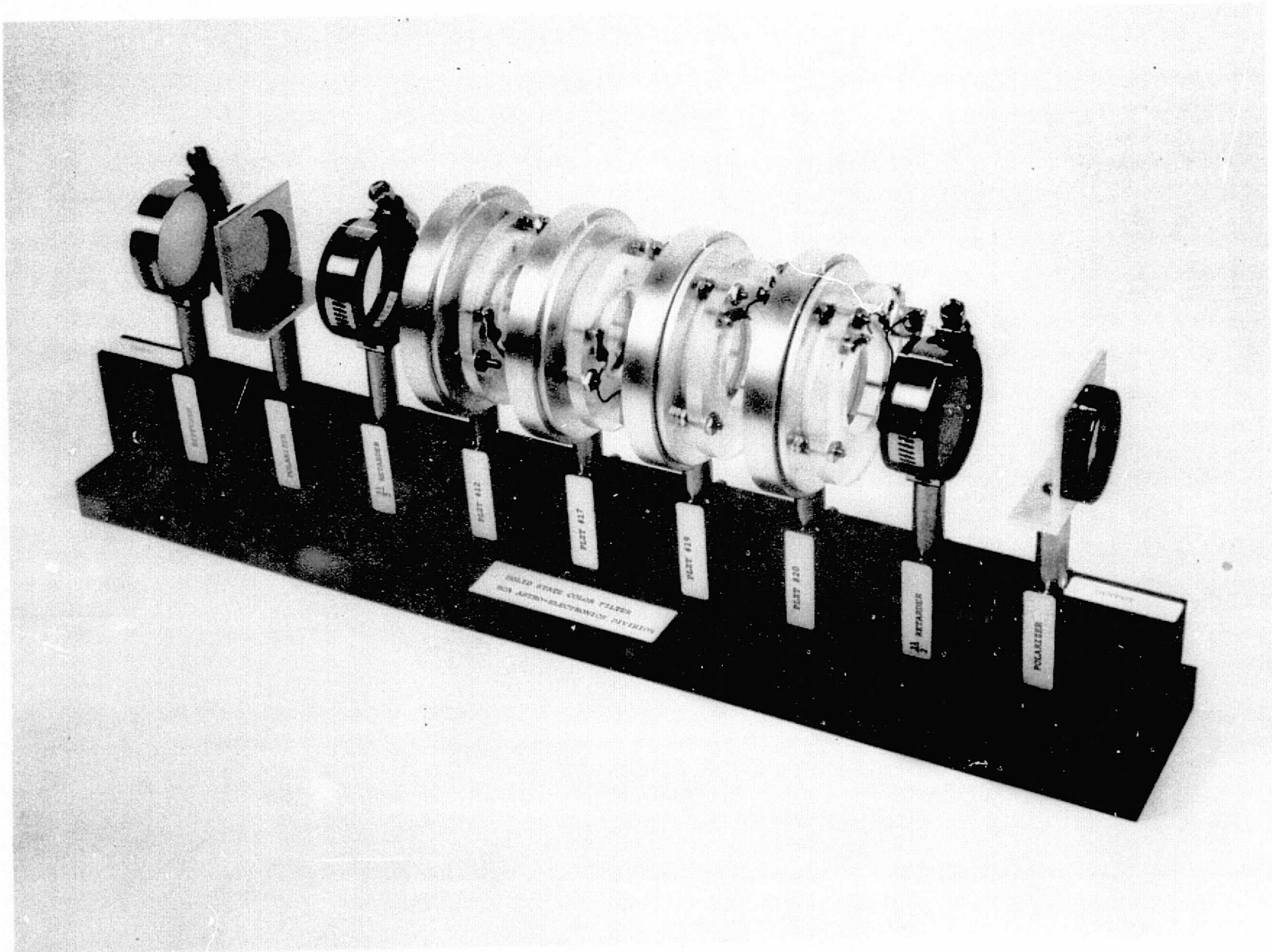


Figure 9. Assembled Network Filter System

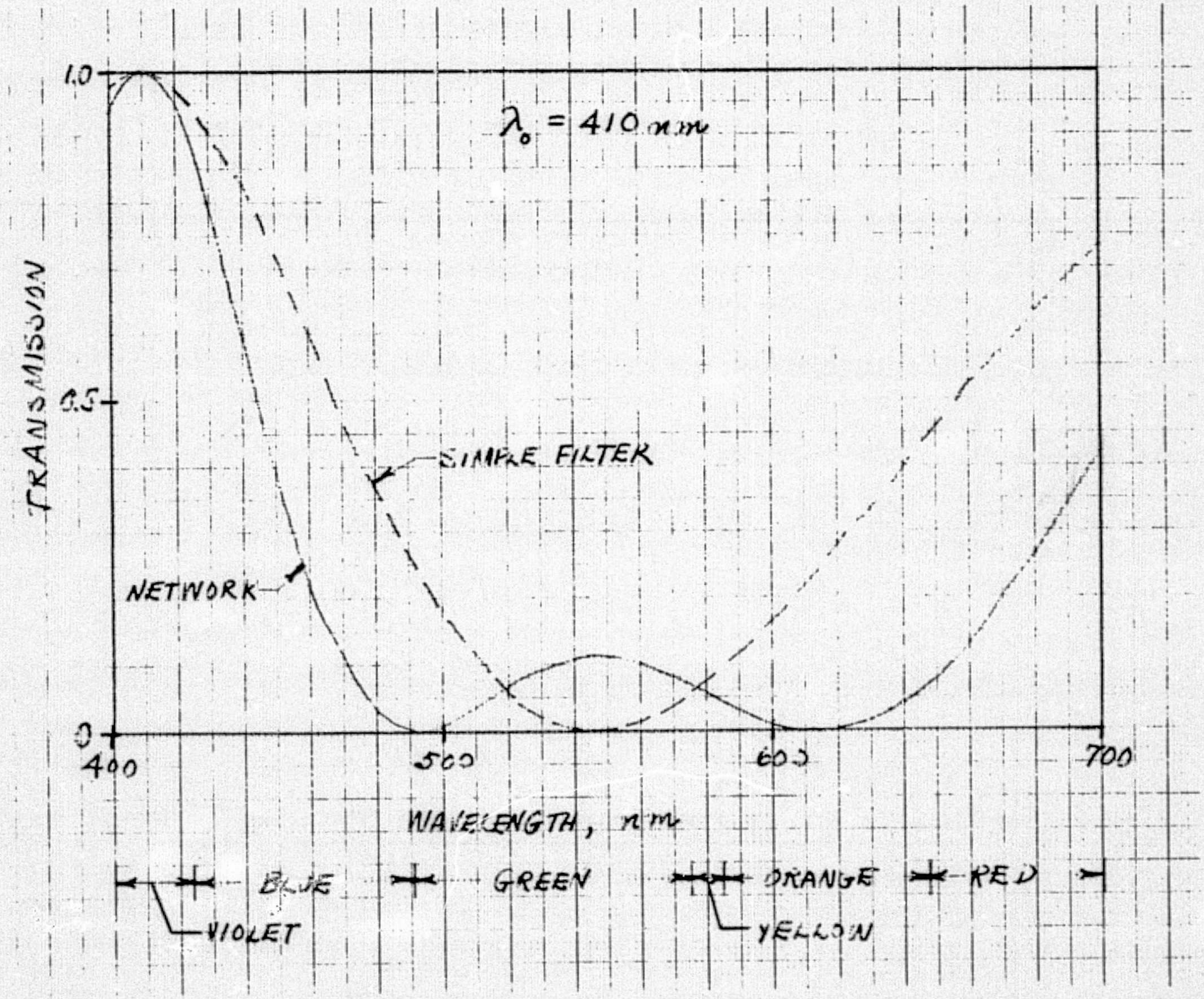


Figure 10. Spectral Transmission, λ_0 = 410 nm

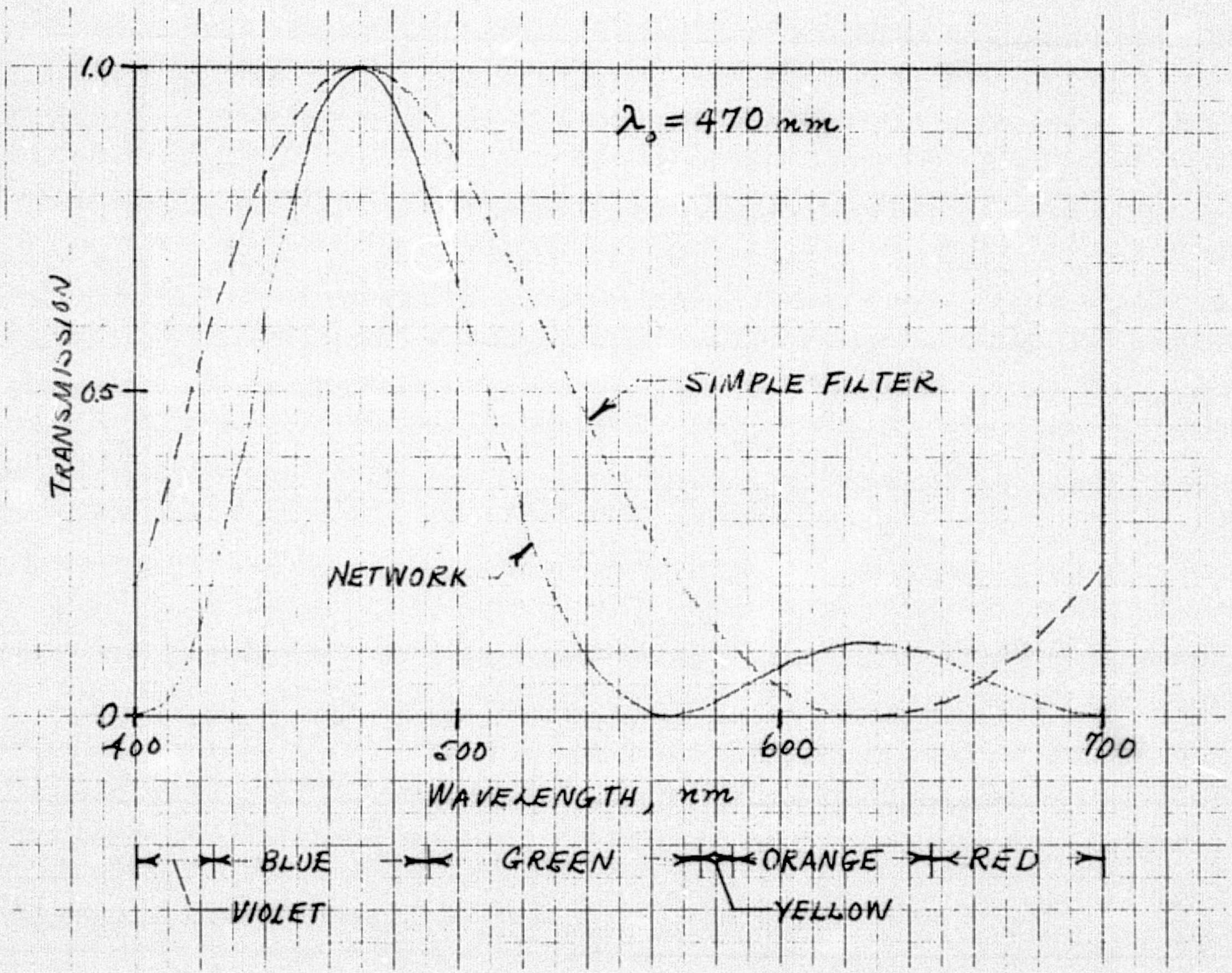


Figure 11. Spectral Transmission, λ_0 = 470 nm

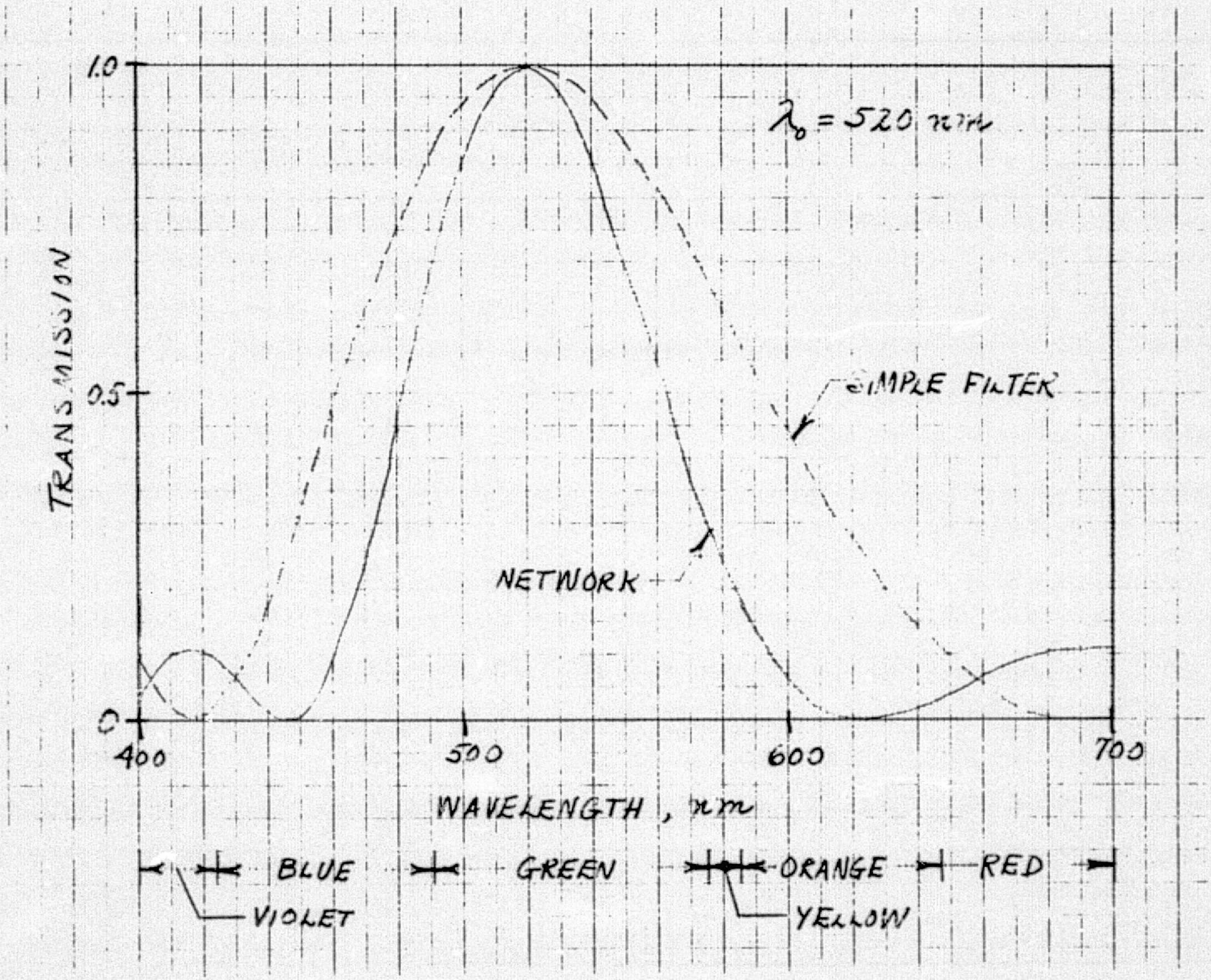


Figure 12. Spectral Transmission, λ_0 = 520 nm

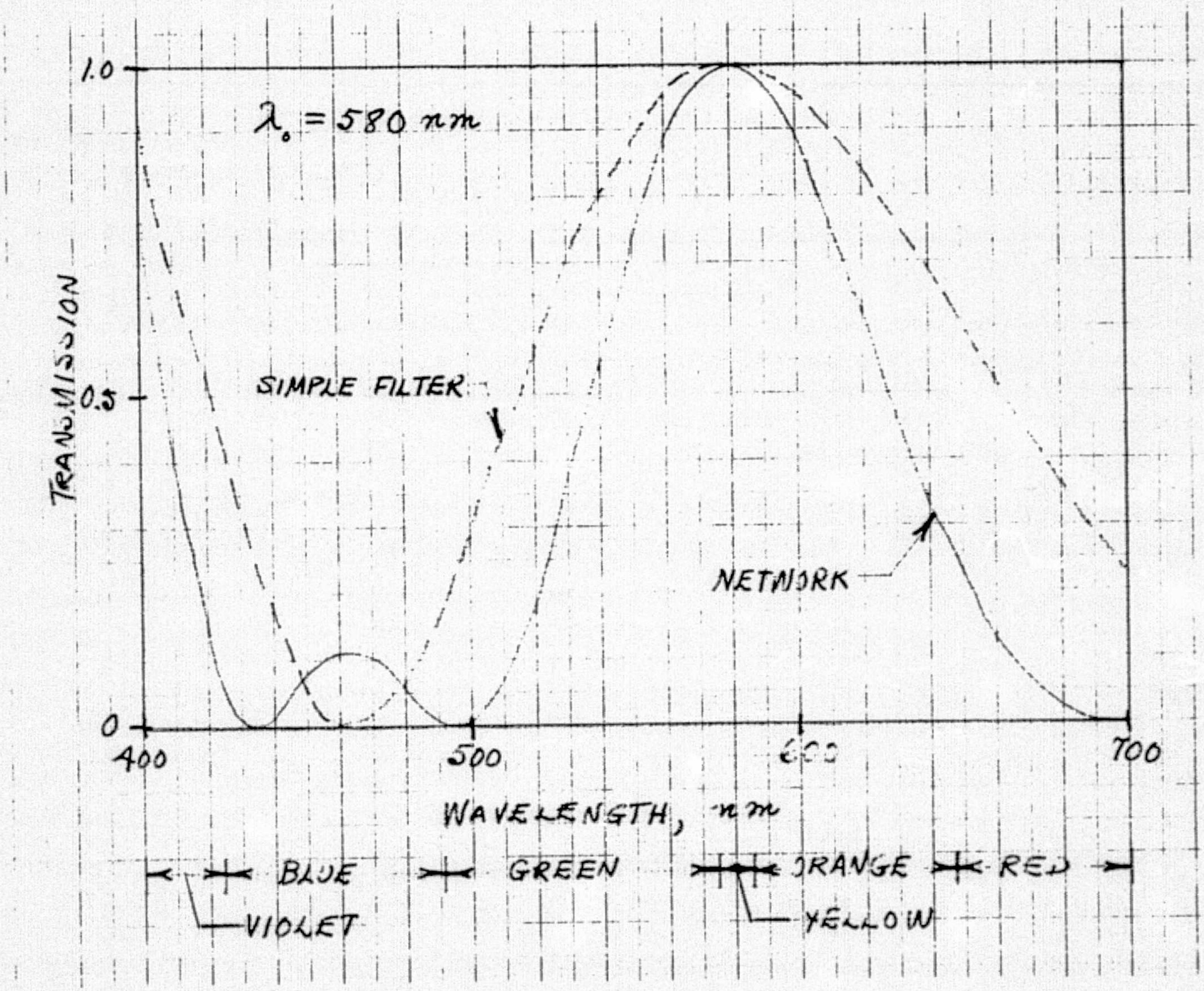


Figure 13. Spectral Transmission, λ_0 = 580 nm

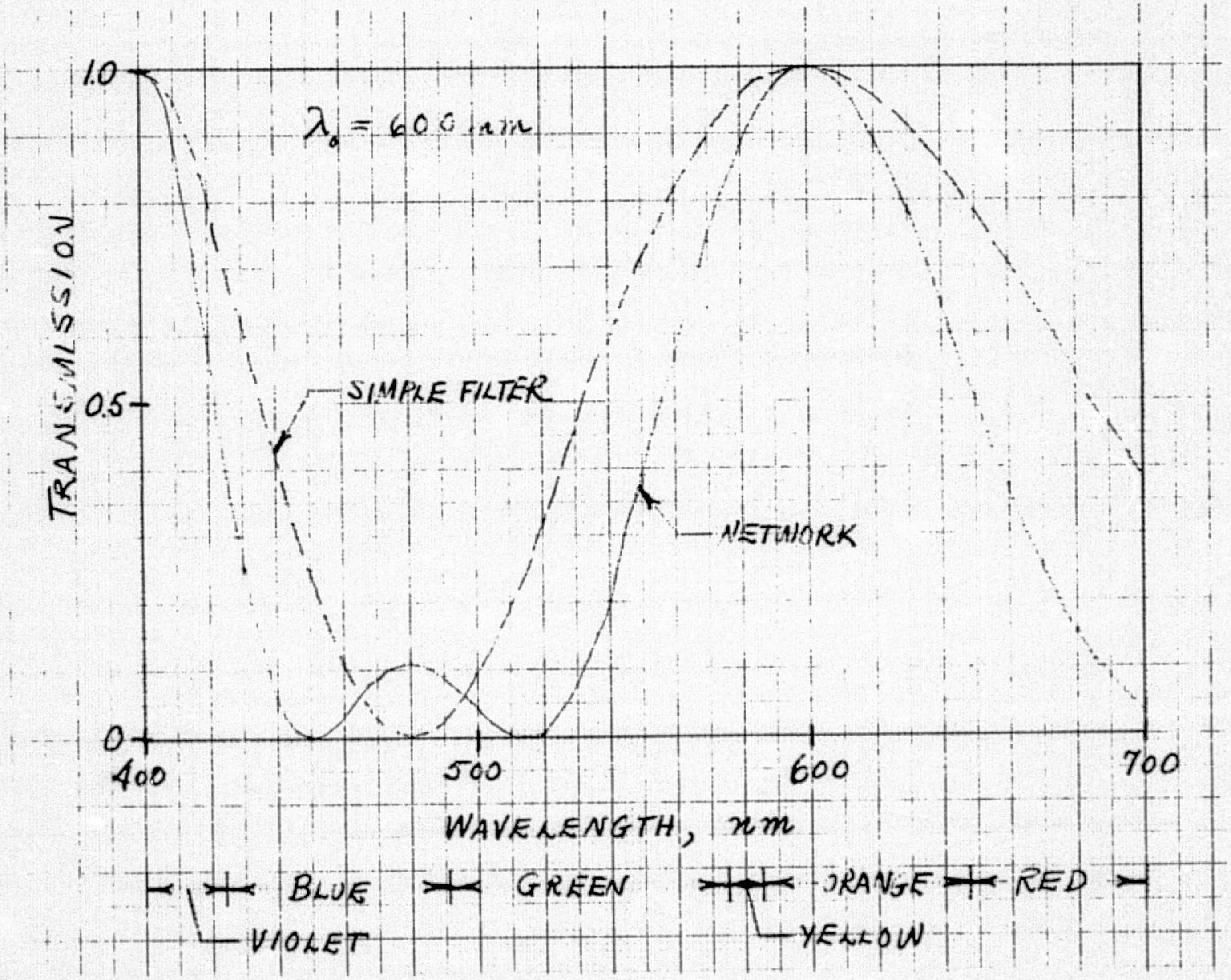


Figure 14. Spectral Transmission, λ_0 = 600 nm

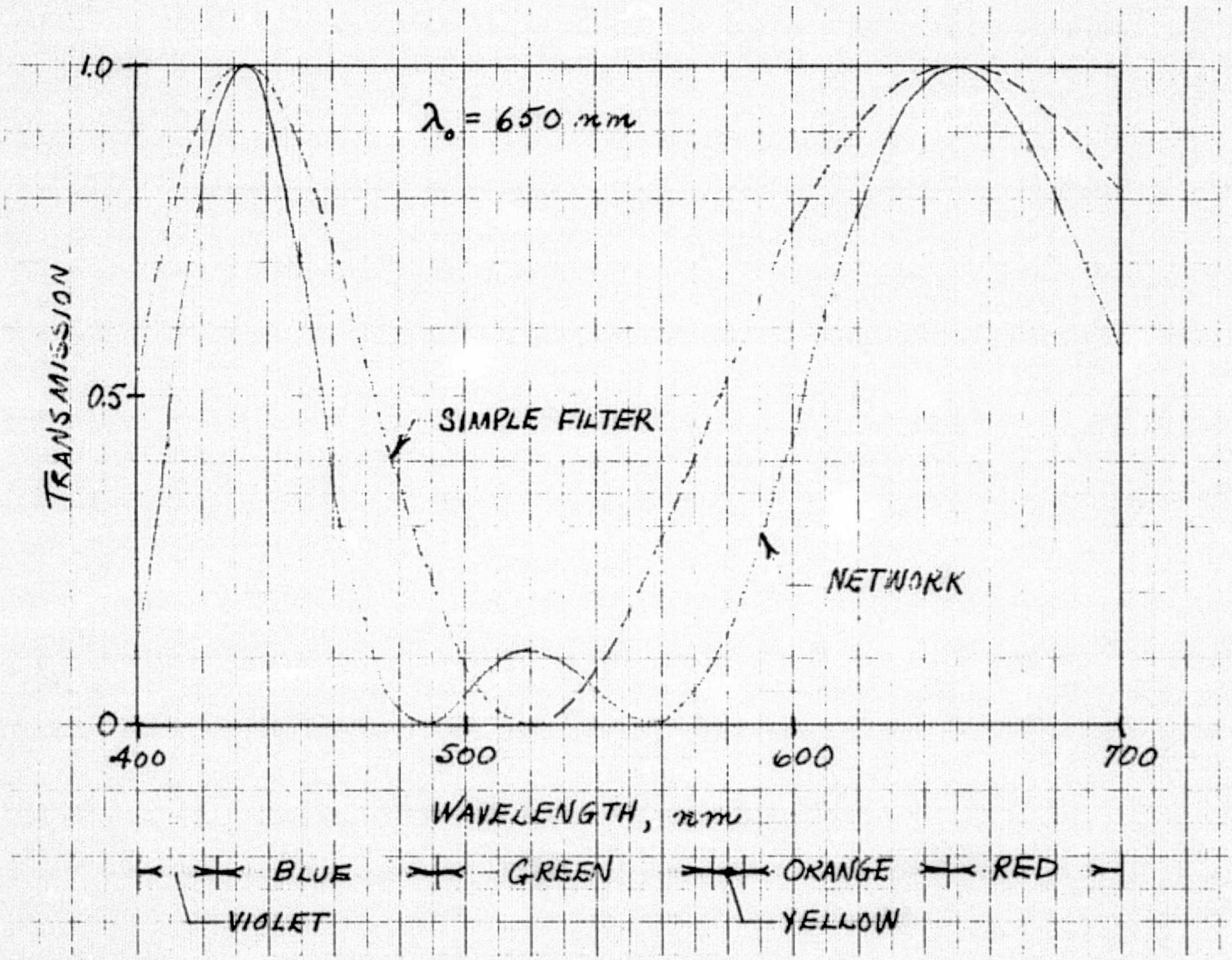


Figure 15. Spectral Transmission, λ_0 = 650 nm

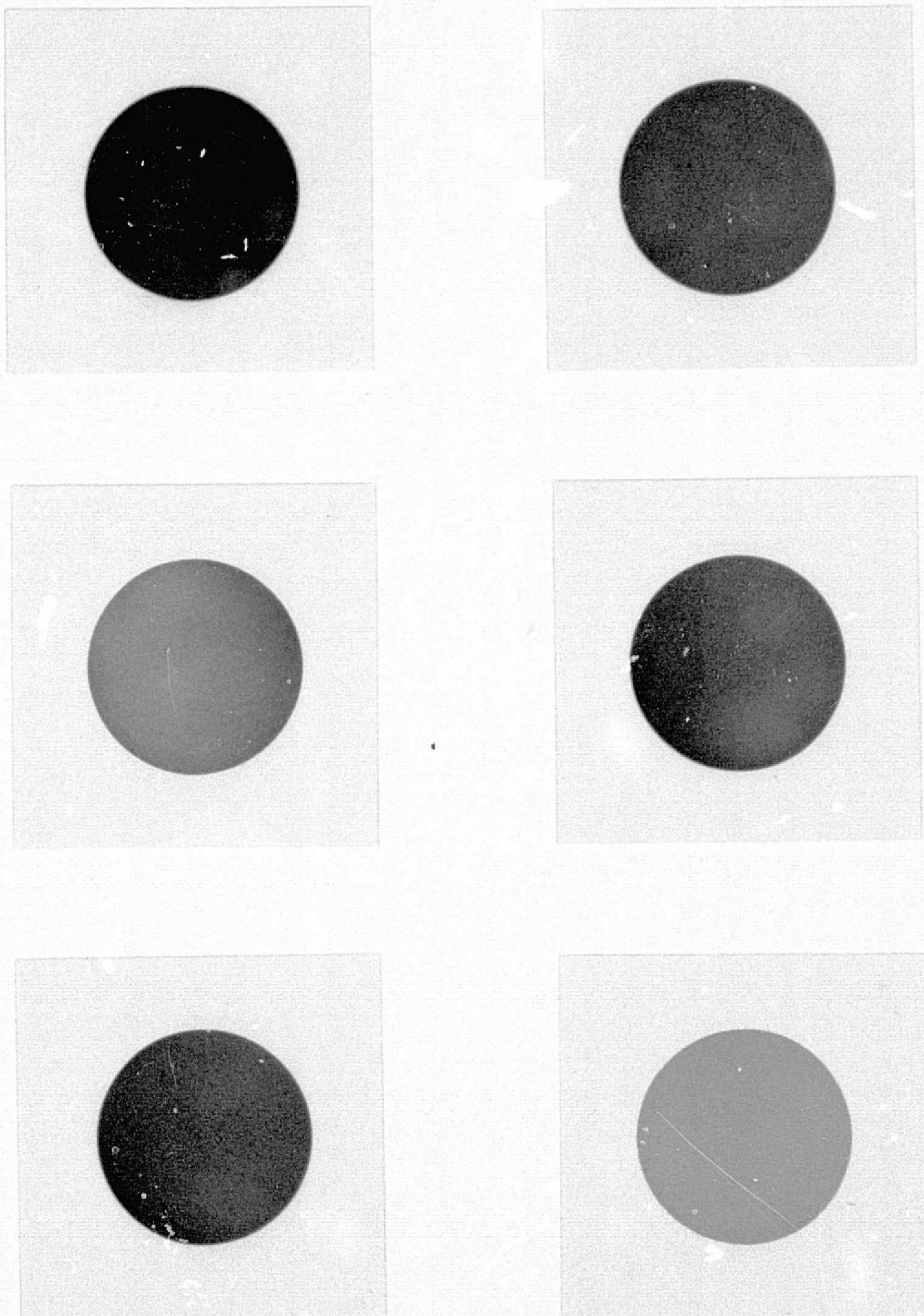


Figure 16a-f. Color Performance, Network System

As with the other program hardware, the assembled color filter is being delivered to NASA/JSC.

4. Alternate Color Filter Design

An alternate technique for implementing a color filter using PLZT switching elements has been previously described (Reference 5, page 41). Briefly, this technique would use special colored polarizers whose transmission shifts between two specific spectral responses under conditions of crossed and parallel polars respectively. These special polarizers would be operated in conjunction with PLZT plates used as half-wave switched retarders.

Colored polarizers with the ideal characteristics are not currently available; however we were able to obtain certain useful samples from Polaroid Corporation. The first of these, designated "blue-to-amber", has the property of passing blue light when viewed through a parallel polar, and amber light when viewed through a crossed polar.

The second material, designated "red-to-neutral", has the property of passing red light when viewed through a parallel polar, and neutral transmission when viewed through a crossed polar.

Two designs for a 3-color filter using the above materials were devised. The first design is shown in Figure 17. In the figure, the labels on the color filters show their responses

for incident light with its electric vector indicated by the double-headed arrow. With no voltages applied to either PLZT plate, blue light is transmitted. With voltage applied to PLZT-2 only, amber light is transmitted. With voltage applied to both PLZT plates, red light is transmitted.

The second design, which has the feature that only one PLZT cell at a time is active, is shown in Figure 18. For this design, with no voltage applied to either PLZT plate, blue light is transmitted. With voltage applied to PLZT-1 only, red light is transmitted. With voltage applied to PLZT-2 only, amber light is transmitted.

The configuration corresponding to the second design was assembled in the laboratory and was found to operate exactly in accord with the predicted results. PLZT plates 1 and 2 required 850 and 610 volts, respectively, for proper operation.

The spectral transmission of the two material samples was measured with a spectrophotometer, using a polarizer with each sample, and a second polarizer in the photometer reference path. Thus the results, shown in Figures 19 and 20, represent the relative transmission for each of the sample states as compared to a single polarizer.

Using these results, the relative transmissions for the assembled filter design (Figure 18) were computed. Retardation Γ for the PLZT plates was calculated from previous data on the particular

plates used. In addition to the three initial states, a fourth state which yielded a salmon color (increased Γ of PLZT-2) was computed.

The computed transmissions are shown in Figures 21 through 24. They indicate conceptually how such a set of filters could be used for three-color separation. The red and blue would be used directly, while green information would be separated from the yellow-orange information by subtracting the red signal.

The material samples available for experimentation were far from ideal; however they do serve to verify the filter technique concept.

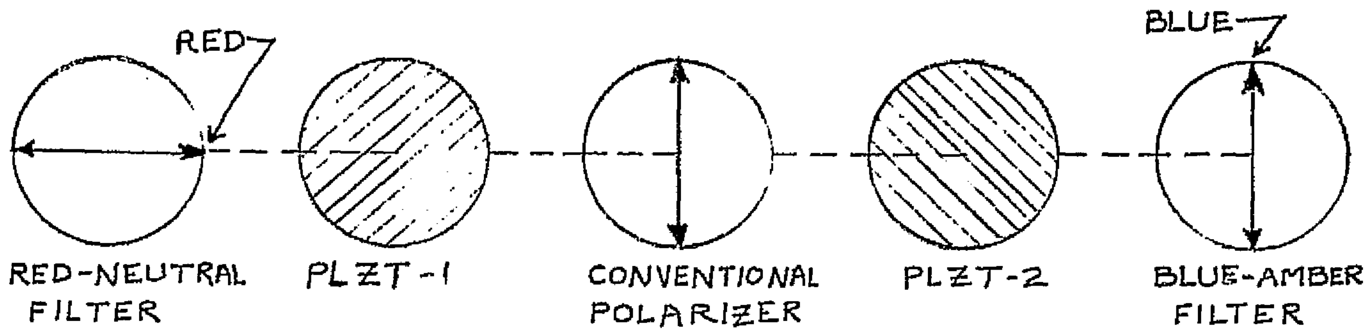


Figure 17. Colored Polarizer Design No. 1

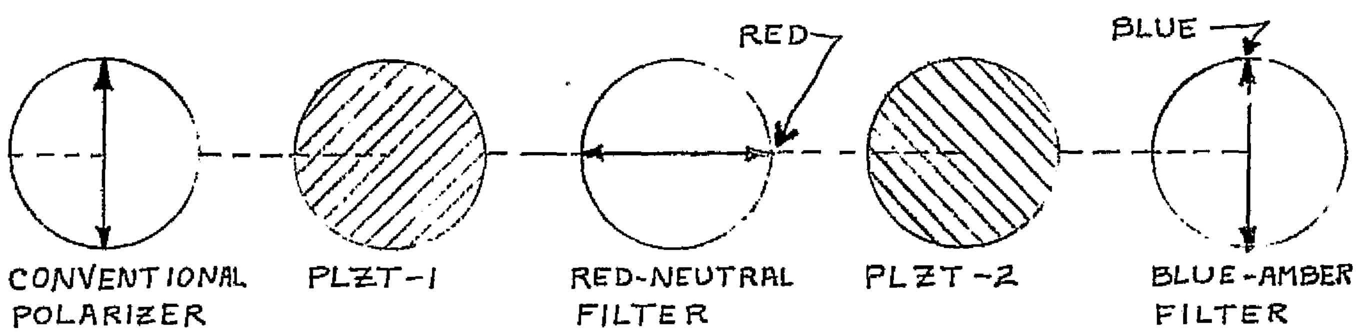


Figure 18. Colored Polarizer Design No. 2

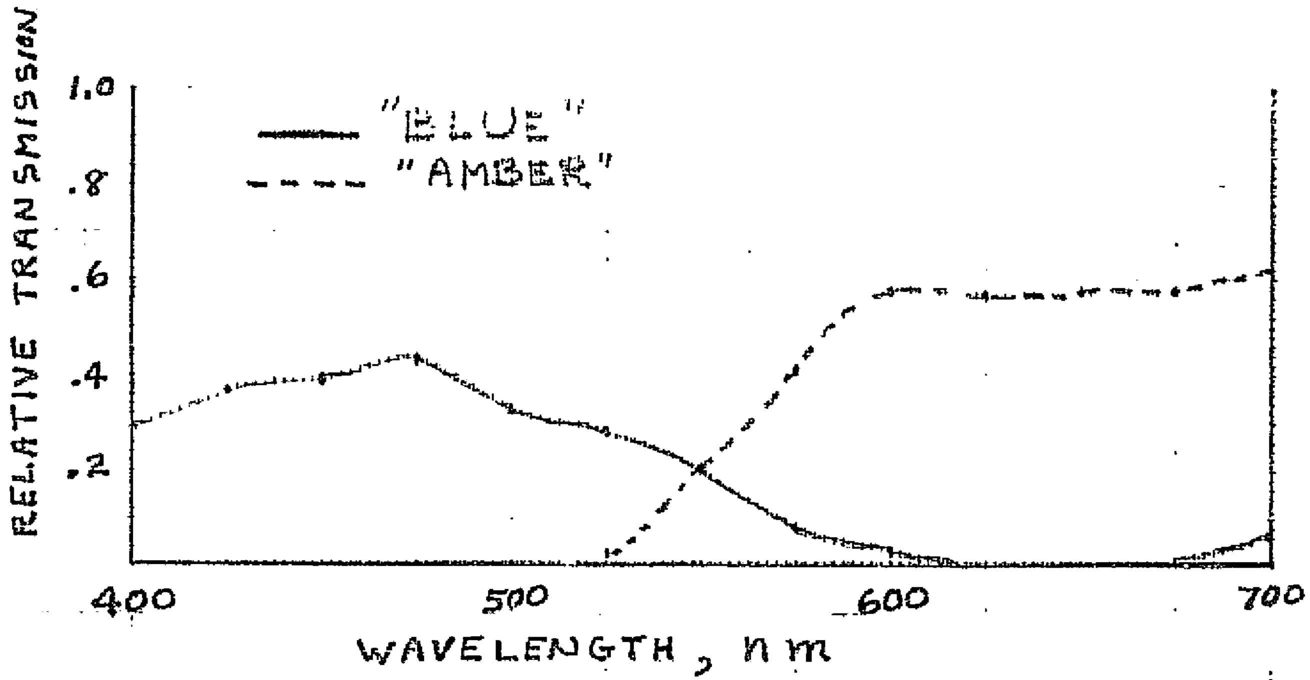


Figure 19. Measured Response, Blue-Amber Polarizer

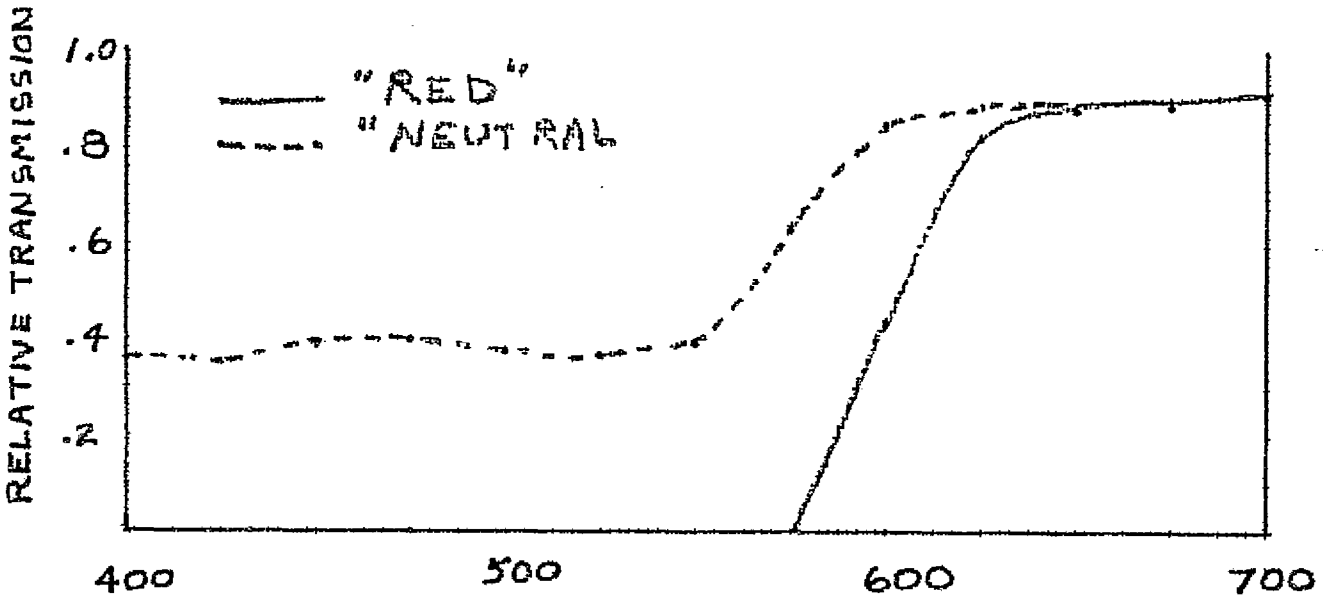


Figure 20. Relative Response, Red-Neutral Polarizer

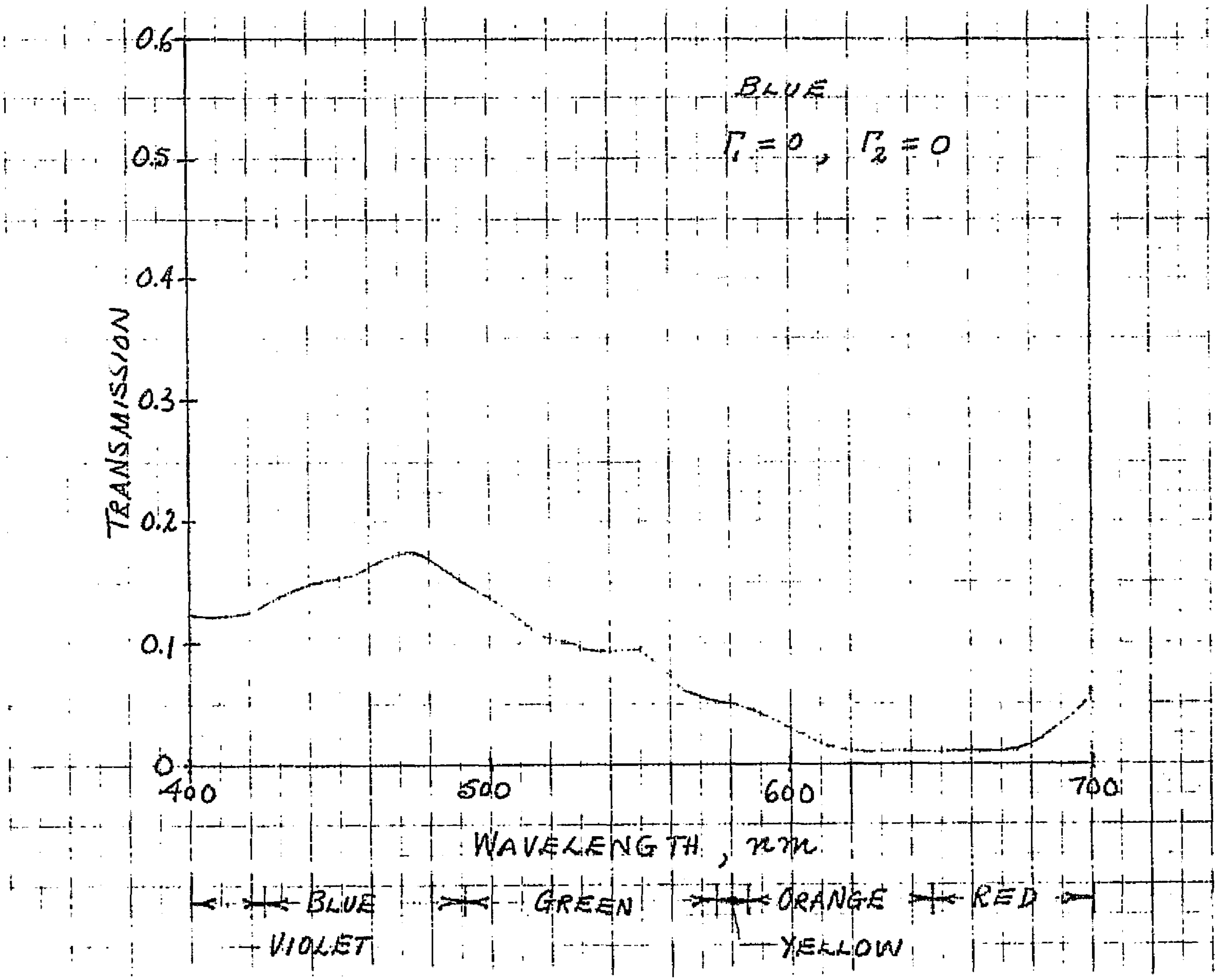


Figure 21. Computed Transmission, Blue Filter

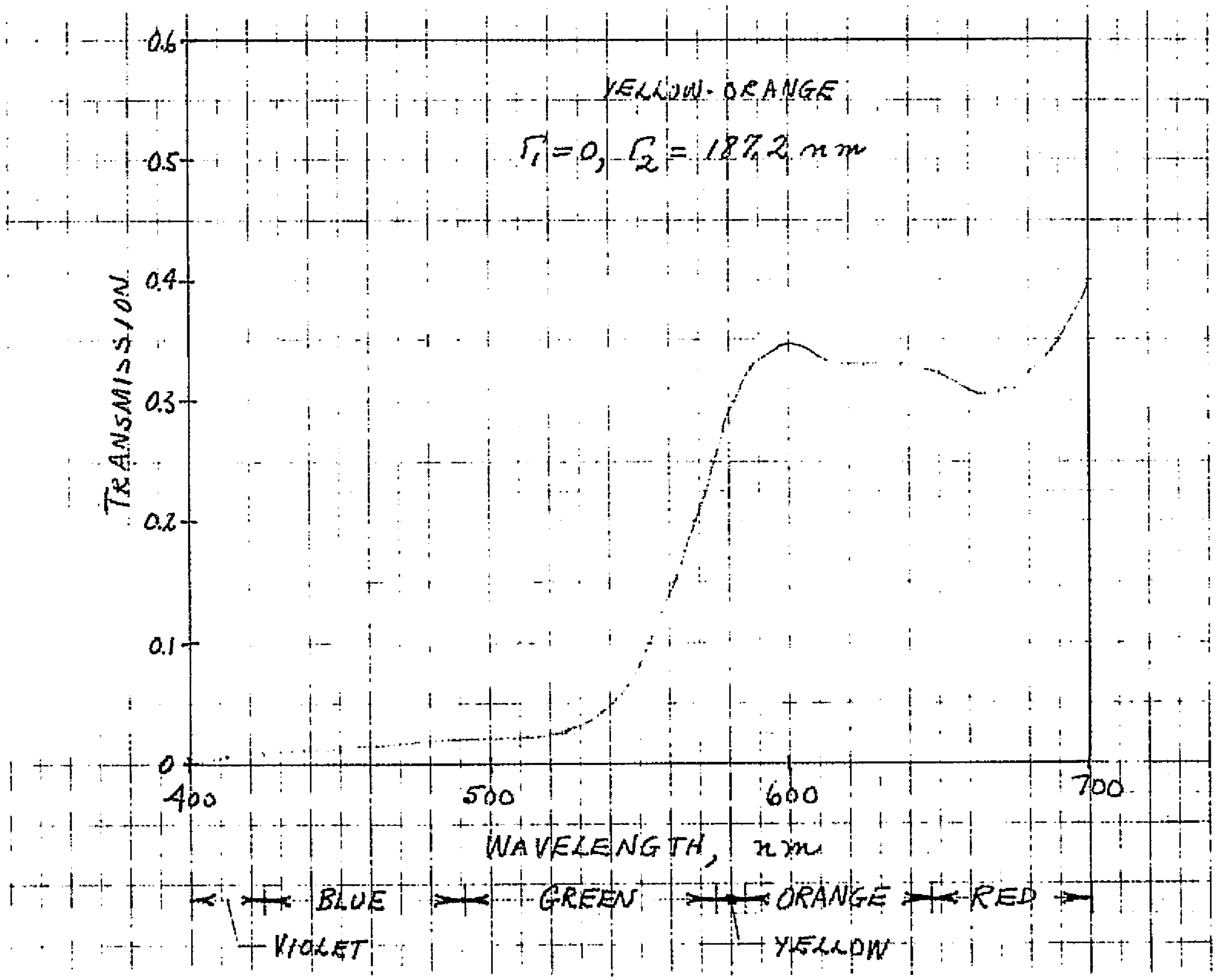


Figure 22. Computed Transmission, Yellow-Orange Filter

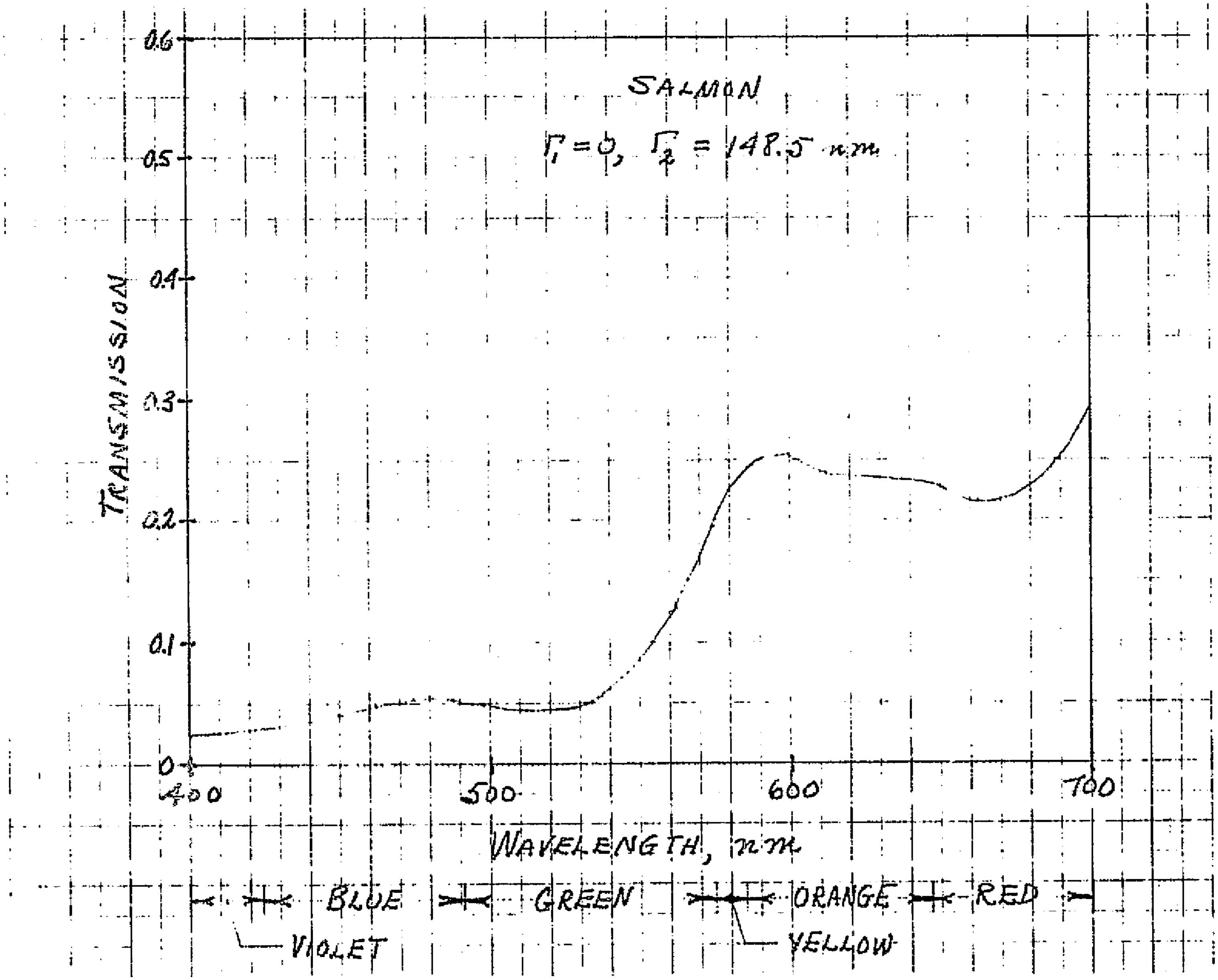


Figure 23. Computed Transmission, Salmon Filter

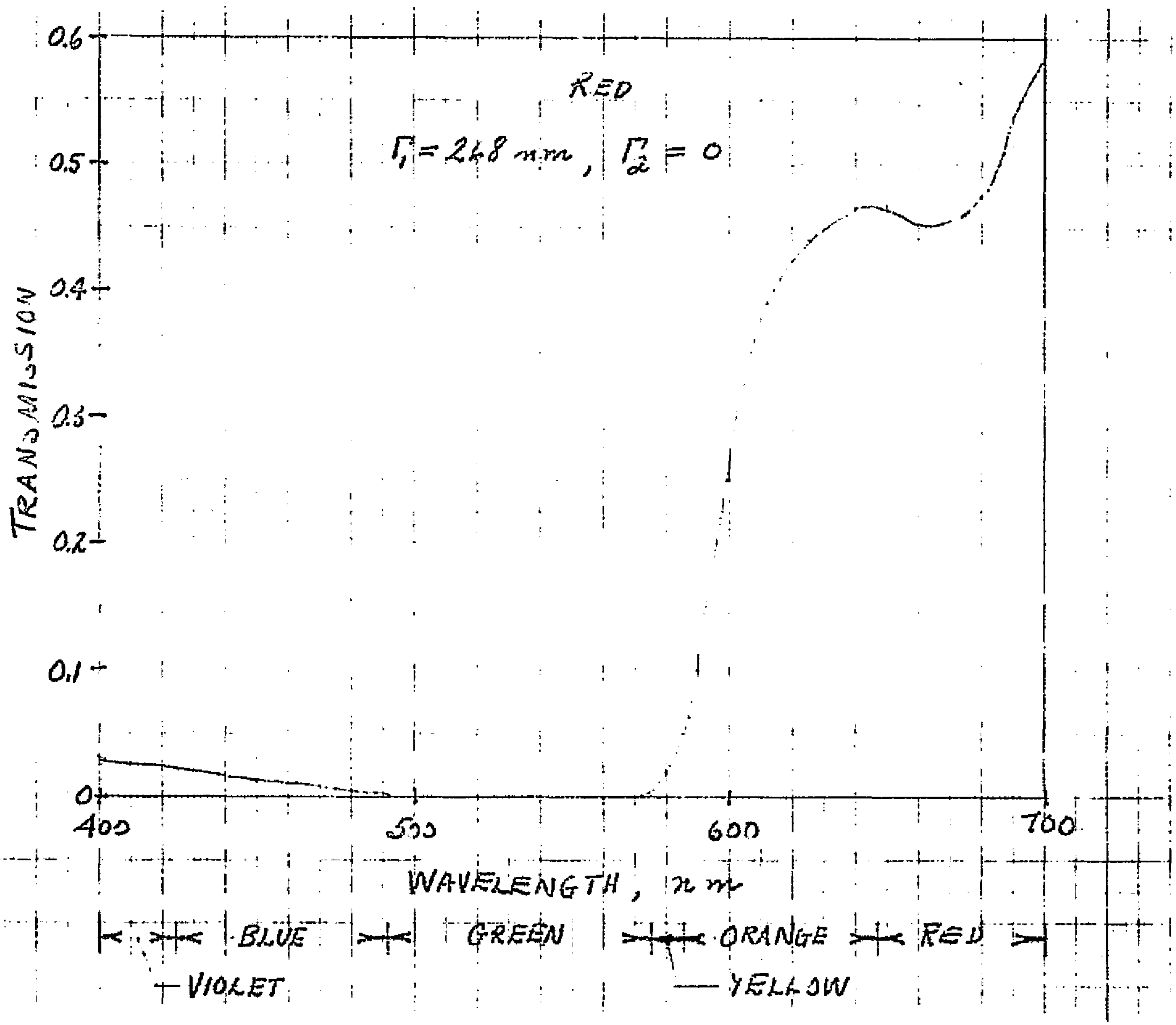


Figure 24. Computed Transmission, Red Filter

F. BONDED FILTER HOLDER

The basic PLZT wafer is delicate, and subject to damage by handling. To provide protection and ruggedness, a holder assembly was designed during Phase II which encapsulates the wafer in Dow-Corning 93-500 elastomer. This material is optically transparent and compliant so as not to mechanically strain the PLZT. The holder is made in three basic pieces, as shown in Figure 25. Front and rear polarizers (or clear glass plates as required by the specific application) are bonded into the outer pieces. The middle section is recessed to hold the PLZT element. Electrical connection to the interdigitated electrodes is accomplished by ultrasonic bonding of several 0.001" lead wires between the wafer finger rings and external contacts, to provide a solid mechanical connection.

After the three parts were assembled and their optical axes aligned, the interior cavities were encapsulated with the 93-500 material. This provides a moisture barrier and mechanical protection. In addition, the absence of an air path provides significant improvement in high voltage breakdown ability.

The initial unit was encapsulated using a vacuum technique to preclude the presence of air bubbles or voids in the cavity. Despite this precaution, internal surface separation was observed after the cure cycle was completed. Initial investigation indicated the problem to be caused by poor adhesion to the ceramic material.

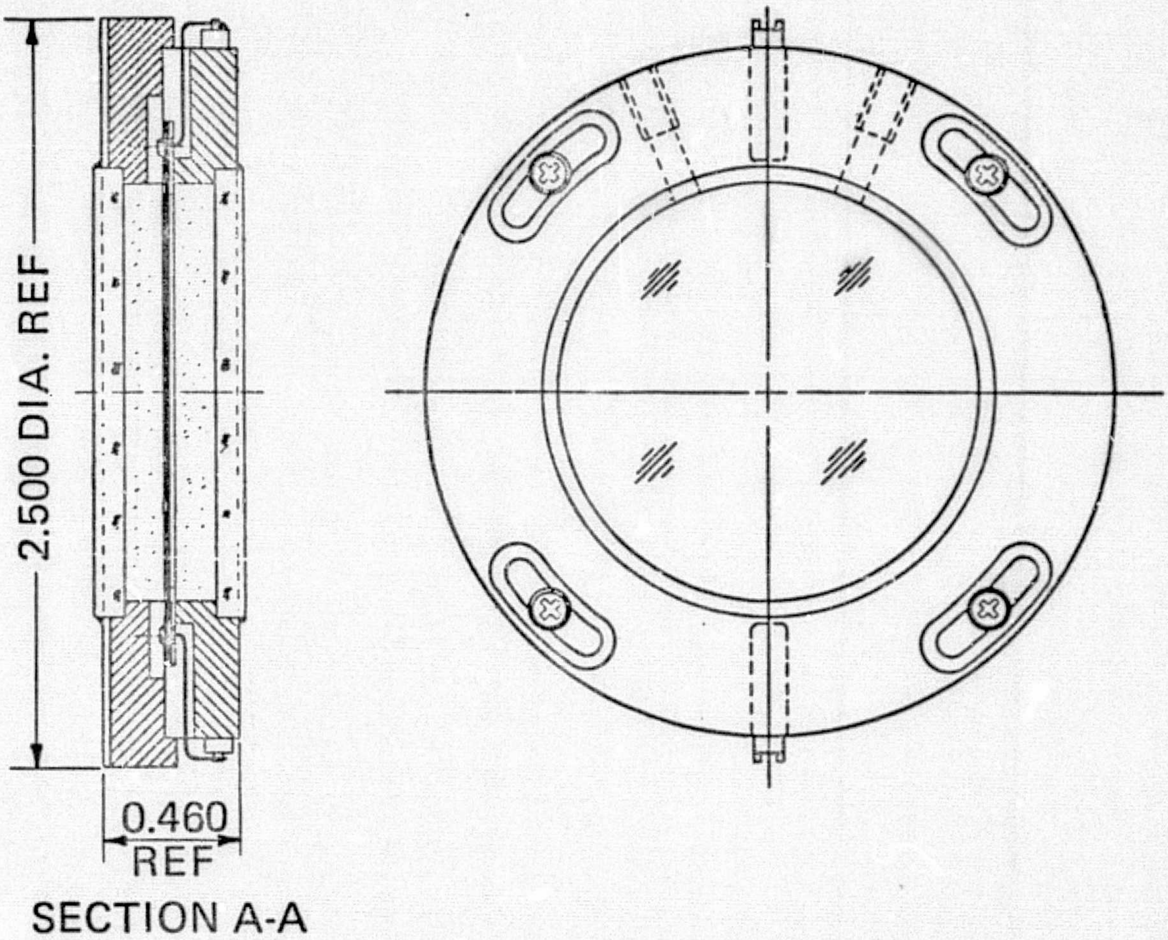


Figure 25. Bonded Holder Assembly

A primer (Sylgard) was identified which would provide an adherent interface between the ceramic PLZT and the 93-500 elastomer. The initial unit assembled with the primer was satisfactory. Subsequent assembled units showed evidence of the original problem. Further investigation showed that bulk shrinkage of the 93-500 during the cure cycle was responsible for the observed separation. The rigidity of the holder housings (required to assure parallelism of the front and rear plates) permits a void to develop as the encapsulant cures.

To resolve this problem, a modified assembly technique was developed which utilizes the basic existing components. The front and rear housings are assembled together with the PLZT support ring, and the exit ports are sealed. After priming of the interior surfaces, one side of the PLZT/holder is filled with 93-500, slightly above flush with the polarizer seat. Following air cure to a set-up state, the assembly is inverted and the opposite side filled in a similar manner. The entire unit is then subjected to an oven cure to permit total bulk shrinkage to occur without constraining cover plates.

After the cure is completed, a thin film of 93-500 is used to bond the polarizers (or cover glass) to the holder assembly. A subsequent oven cure completes the modified assembly procedure. Since the bonding film is very thin compared to the total elastomer thickness, the total percentage path shrinkage is slight,, and the original void source is eliminated.

The above modified technique was used to assemble the bonded filter which is integrated into the GCTA CTV camera. The applicable assembly and detail drawings have been modified to show the revised procedure. Copies of the revised drawings are included in Appendix A.

G. MODIFIED CTV CAMERA

As described in the introduction, a requirement of Phase III was to integrate an engineering model of the new holder assembly with a GCTA CTV camera (supplied as GFP). Basic camera electrical modifications were previously developed. They included the design of auxiliary electronics and an external control panel to select the operating mode. An external programmed power supply is used to furnish the operating voltage for the PLZT element. Details of the original modifications are identified as follows (references are to material contained in Reference No. 6):

• System Block Diagram	Figure 44
• Control Panel Layout	Figure 45
• Schematic Diagram	Figure 46
• Functional Description	Section II-G-2

The original modifications were evaluated with an early sample PLZT element, mounted in a phenolic holder. To incorporate the new holder design, an adapter was designed to

replace the original camera gear housing. The adapter is machined from aluminum to the same outer configuration as the original housing. An internal cavity and seat are provided to secure the PLZT holder assembly using two of its integral mounting bolts. The front of the adapter is machined to accept the original zoom lens mounting flange.

Electrical connections are routed through a connector, installed in the rear face of the original camera switch housing. Provision is included for separately adjusting the potential applied to the PLZT element, if desired for laboratory experimentation. The resultant assembly is sealed as an integral unit, yet easily accessible for inspection or modification.

H. LIST OF REFERENCES

1. NASA Technical Brief No. B74-10223.

2. B. Lyot, Ann d'Astrophys, 7, 31 (1944).

3. J. W. Evans, J. Opt. Soc. America, 39, pp. 229-42 (1949).

4. I. C. Chang, et al, J. Opt. Soc. America, 54, pp. 1267-79 (1964).

5. Second Interim Technical Report, Contract NAS 9-13549, (AED R-4064)

6. First Interim Technical Report, Contract NAS 9-13549, (AED R-4013F)

I. CONCLUSIONS AND RECOMMENDATIONS

The basic objectives of each of the three program phases have been successfully accomplished. PLZT ceramic wafers, in conjunction with other system elements, have been shown to be capable of performing a variety of electro-optic functions. Electrode contact problems noted on early samples were eliminated on samples using carefully controlled processes. A sealed holder was developed to protect the relatively fragile PLZT wafer from an adverse environment.

The improved characteristics, in conjunction with suitable polarizers, enabled the assembly of a neutral variable light control gate of wide dynamic range. Such a light gate can be employed in lieu of a motor driven iris for exposure control, or as a shutter element for camera shuttering or in conjunction with a field-sequential stereo TV system.

The color filter mode of operation using PLZT has been demonstrated to be feasible. Single stages lack the ability to provide adequate spectral separation for high-quality color camera performance. Cascaded optical networks can provide a reasonably close match to the objective transmission curves. Such cascaded networks are relatively complex, requiring a multiplicity of elements (as described in Section II-E-3) aligned at very precise angles. Implementation of such a color filter system in a practical assembly for aerospace applications is considered difficult but possible. A simpler system which shows the potential for good performance utilizes special colored polarizers.

This system, described in Section II-E-4, requires further development in the area of the specific transmissions of the individual polarizers. The reduced number of optical elements would significantly decrease the complexity of assembly. It is recommended that development of such improved colored polarizers be investigated.

In addition, since conventional polarizers are used in each of the other applications, investigation of polarizing material with greater transmission is recommended. The insertion loss of current polarizers is the limiting factor in the "on" transmission of the variable density filter application.

The field-sequential stereo TV system using PLZT switching elements provides excellent stereo separation with minimal complexity in the related equipment. The system should be considered for use wherever the advantages of stereo TV must be employed. This would be, for example, in conjunction with a remote manipulator for payload or hazardous material handling. The switching optical elements present little interference to normal vision, since the front polarizer is fixed to the monitor screen. Thus the user is able to carry out normal activities while wearing the required stereo TV headset.

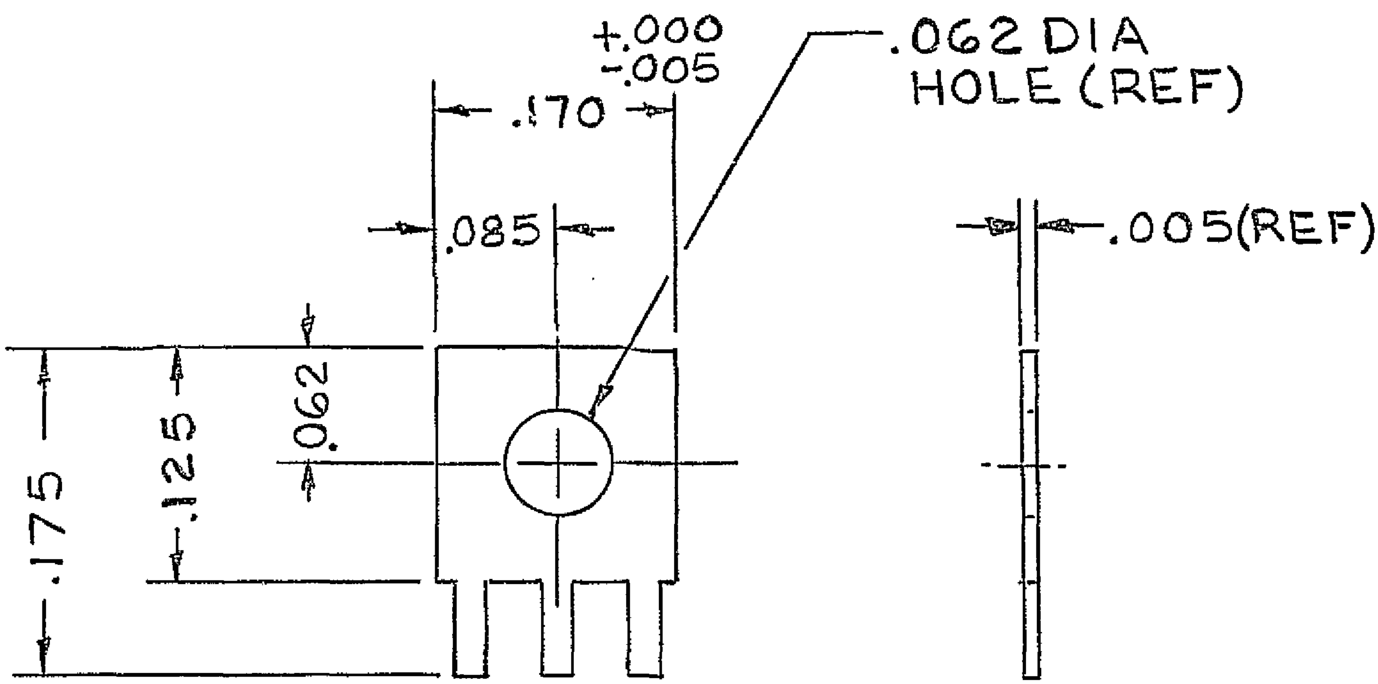
APPENDIX "A"

ENGINEERING DRAWINGS

The following pages contain copies of the applicable engineering drawings developed or modified during Phase III of the contract. These drawings are identified as follows:

Drawing No.	Title
SK2273410	Finger Contact
SK2282385	PLZT Support Disk
SK2282386	PLZT Support Assembly
SKPL2282386	PLZT Support Assembly Parts List
SK2283896	Polarizer Holder
SK2283897	Analyzer Holder
SKPL2283897	Analyzer Holder Parts List
SK2284259	PLZT Holder Assembly
SKPL2284259	PLZT Holder Assembly Parts List
SK2285131	PLZT Holder Assembly Notes
SK2284585	Stereo Headset Assembly
SKPL2284585	Stereo Headset Assembly Parts List
SK2288251	Stereo TV Electronics Schematic
-	Stereo TV Electronics Assembly, Front
-	Stereo TV Electronics Assembly, Rear
-	Stereo TV Electronics Parts List
SK2282706	Polarizing Filter Clamps
SK2288064	Polarizing Filter Assembly
SKPL2288064	Polarizing Filter Assembly Parts List
SK2288065	Polarizing Filter Frame
AM12875-1	PLZT Color Filter Holder Parts

Drawing No.	Title
AM12875-2	PLZT Color Filter Holder Parts
AM12875-3	PLZT Color Filter Holder Parts
AM12875-4	PLZT Color Filter Holder Parts
AM12875-5	PLZT Color Filter Holder Parts
AM12875-6	PLZT Color Filter Holder Assembly



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UP TO 6	±.02	±.005
ABOVE 6 TO 24	±.03	±.010
ABOVE 24	±.06	±.015

ANGULAR DIMENSIONS ±½°

SEE RCA PURCH SPEC FOR STOCK TOL

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ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING, AND CLASS 2 AFTER PLATING. ALL INTERNAL THREADS TO BE CLASS 2B, UNLESS OTHERWISE SPECIFIED.

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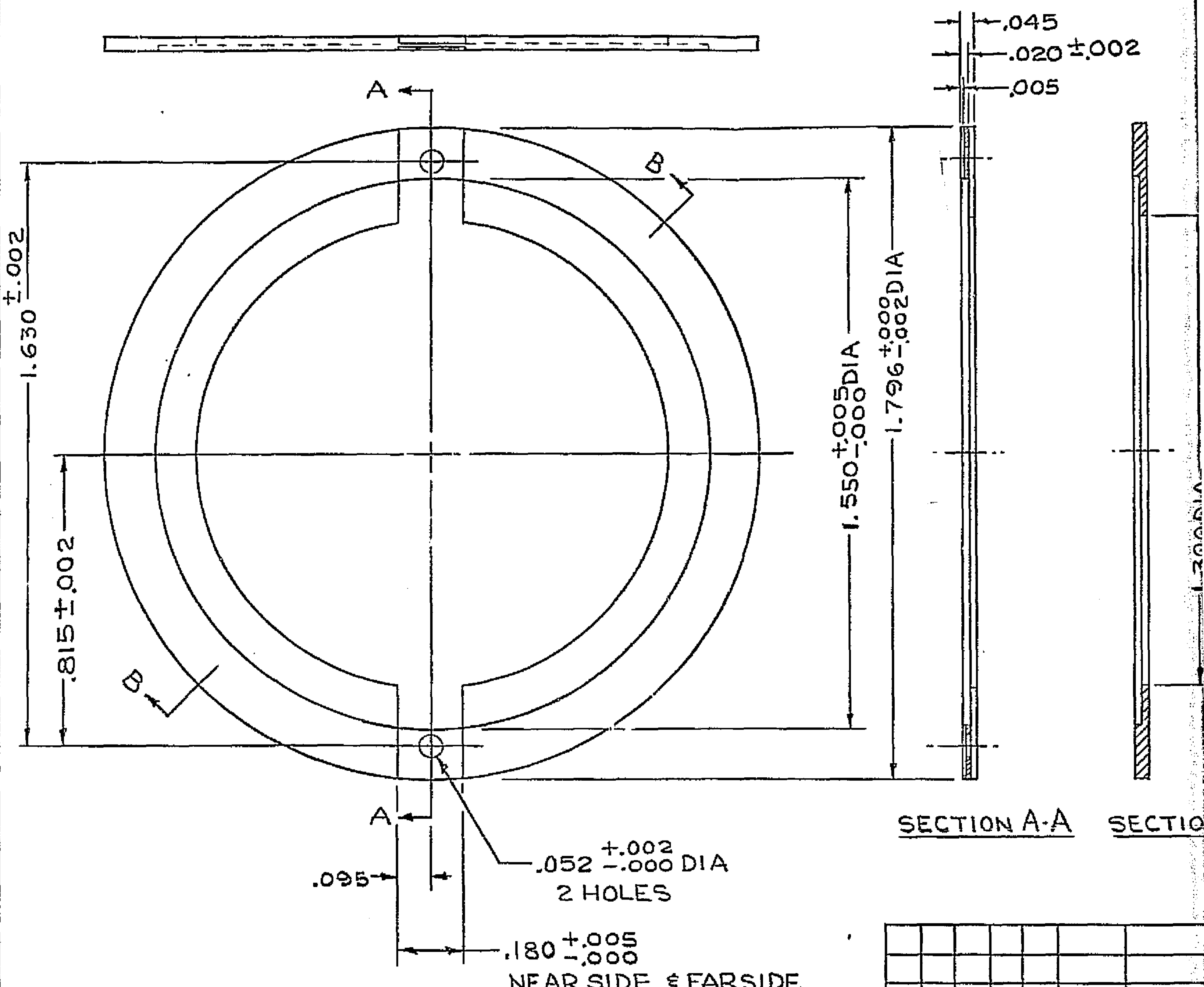

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ABOVE 6 TO 24	± .03	± .015
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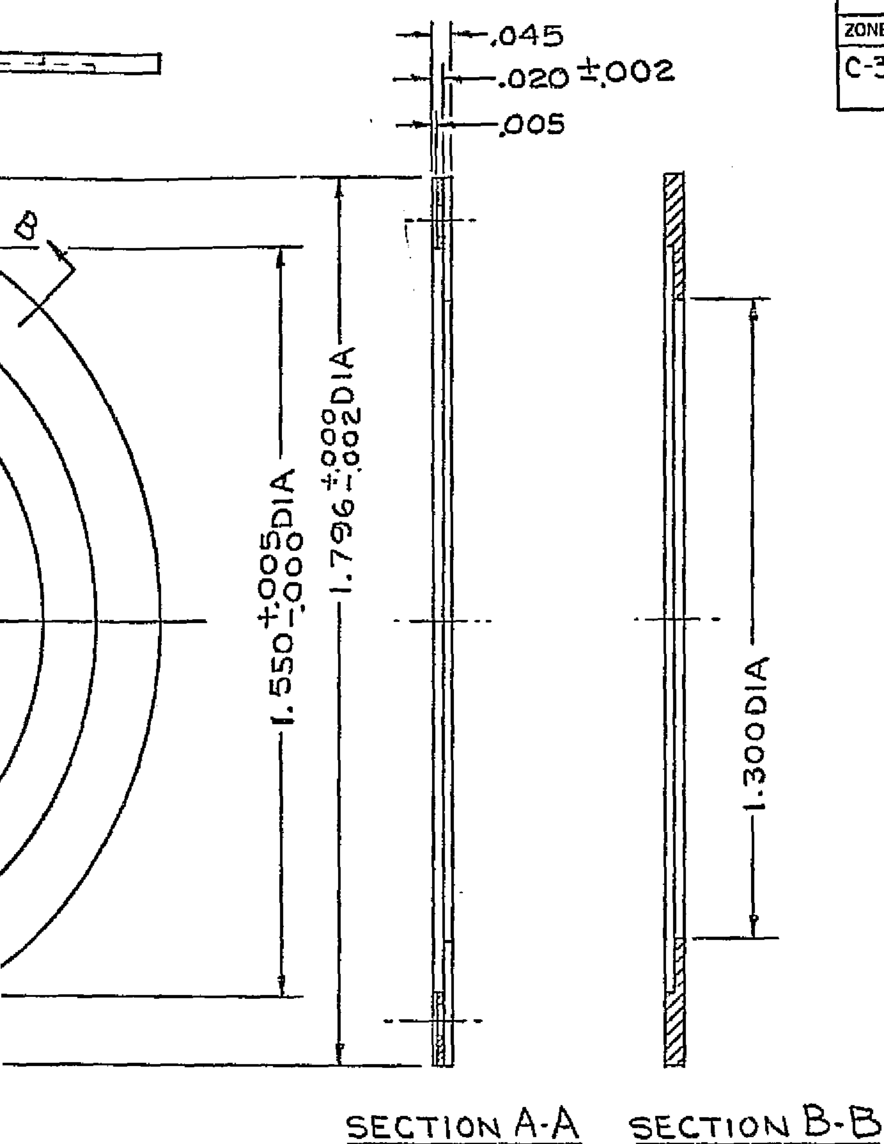

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MATERIALS AND SPECIFICATIONS

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ANGULAR DIMENSIONS ± 1/2 °

RCA COMMODITY CODE:

CONTRACT NO. NAS9-13549 REL

DRAWN [signature] Sept 26, 1974 DATE

CHECKED [signature] Oct 16, 1974 DATE

DESIGN ACTIVITY APPD. [signature] DATE 16 Oct 74

RCA CORPORATION | NEW YORK, NY

RCA ASTRO-ELECTRONICS DIV, PRINCETON, N.J PLANT

PLZT SUPPORT DISC

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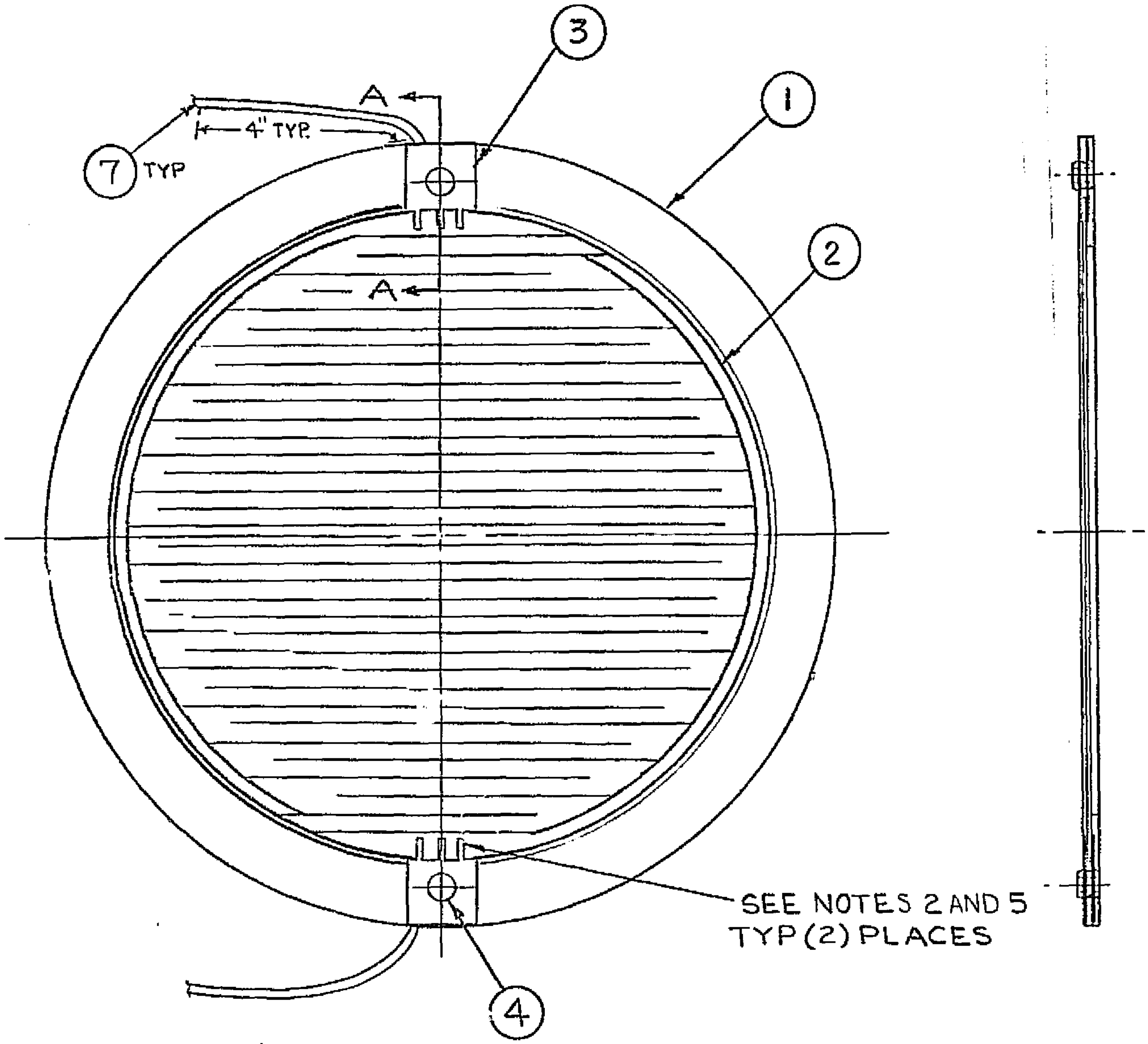

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NOTES:

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2. BEND UP FINGERS OF ITEM 3 ON UPPER SIDE TO PERMIT INSTALLATION OF ITEM 2.
3. INSTALL ITEM 2 AS SHOWN WITH PATTERN ON UPPER SIDE AND HORIZONTAL THEN STRAIGHTEN FINGERS ON ITEM 3. USE EXTREME CARE AS SLIGHT STRESS ON ITEM 2 MAY FRACTURE MATERIAL.
4. APPLY FOUR DABS (1/8") OF ITEM 8 TO CIRCUMFERENCE OF ITEM 2 TO SECURE TO ITEM 1. OVEN CURE FOUR HOURS AT 50°C.
5. ATTACH ITEM 3 TO ITEM 2 PER ITEM 6 ULTRASONIC WELDS (.001 WIRE).
6. ATTACH ITEM 7 TO ITEMS 3 AND 4 USING ITEM 9.

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ABOVE 6 TO 24	± .03	± .015
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REVISIONS				
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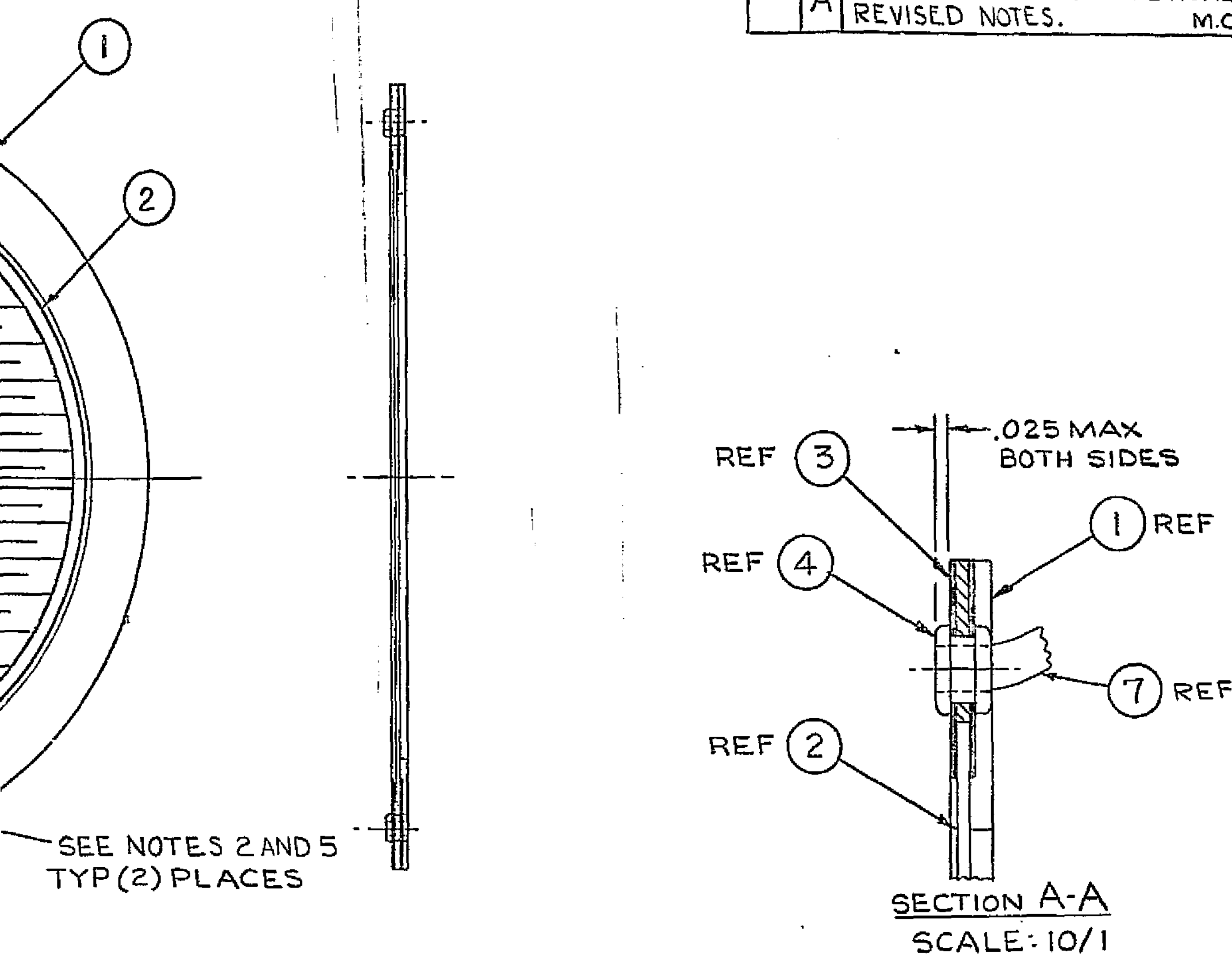

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FOR PARTS LIST SEE PL SK2282386

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MATERIALS AND SPECIFICATIONS

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THE DATA TO BE INTERPRETED USING NBS HDBK H28 AND MIL-STD-9		CHECKED DATE Jon F. Bradley Oct. 14, 1974	
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ABOVE 6 TO 24	± .03	± .015
ABOVE 24	± .06	± .020

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	CHECKED BY / DATE: Lewis E. Boodley Oct. 16, 1974		CONTRACT NO. NAS9-13549	
	DESIGN ACTIVITY APPD / DATE: [illegible] 16 Oct 74			

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED	LTR	DESCRIPTION	DATE	APPROVED
A	ADDED -2 TO ITEM 4. ADDED PART NO. TO ITEM 6. ADDED ITEMS 7, 8 AND 9. M.C.G.	March 10 1975	Bert M Sl[illegible]				

INTERPRET SYMBOLS USED AS FOLLOWS:

UNITS OF MEASURE (UM)	QUANTITIES	SYMBOL
A — Inches, B — Feet, C — Yards, D — Ounces, E — Pints, F — Quarts, G — Gallons, H — Barrels, J — Pounds, L — Pair, M — Set, N — Kit, P — Roll, R — Box, Case, T — Each	X — Applicable document; O — For ref only	U — Govt or customer furnished; K — Govt or customer furnished and installed; * — Vendor item. See specification or source control drawing.

Parts List / Worksheet

Astro Electronics

Next Higher Assembly No

Shop Order

Contract

Prepared by HOZALSKI

Date 9/26/74

Checked by

Date

Assembly Number	Rev	Shop Order	Assembly Title	PL Number
SK2282336	A	FA4000	PLZT ASSEMBLY	SK2282336

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1	1		SK2282385-1	PLZT SUPPORT DISC
2	1		SK2273418-1	PLZT ELECTRODE CONTACT
3	4		SK2273410-1	CONTACT FINGERS
4	2		999308-2	RIVET, TUBULAR
5	X		8030022	SPEC., WORKMANSHIP
6	X		MP543-1435	ULTRASONIC WIRE BONDING
7	AR		999125-9	WIRE, #28
8	AR	56717	2260977-1	POTTING, SILICONE, DOW 93-500
9	AR		2010858-1	SOLDER

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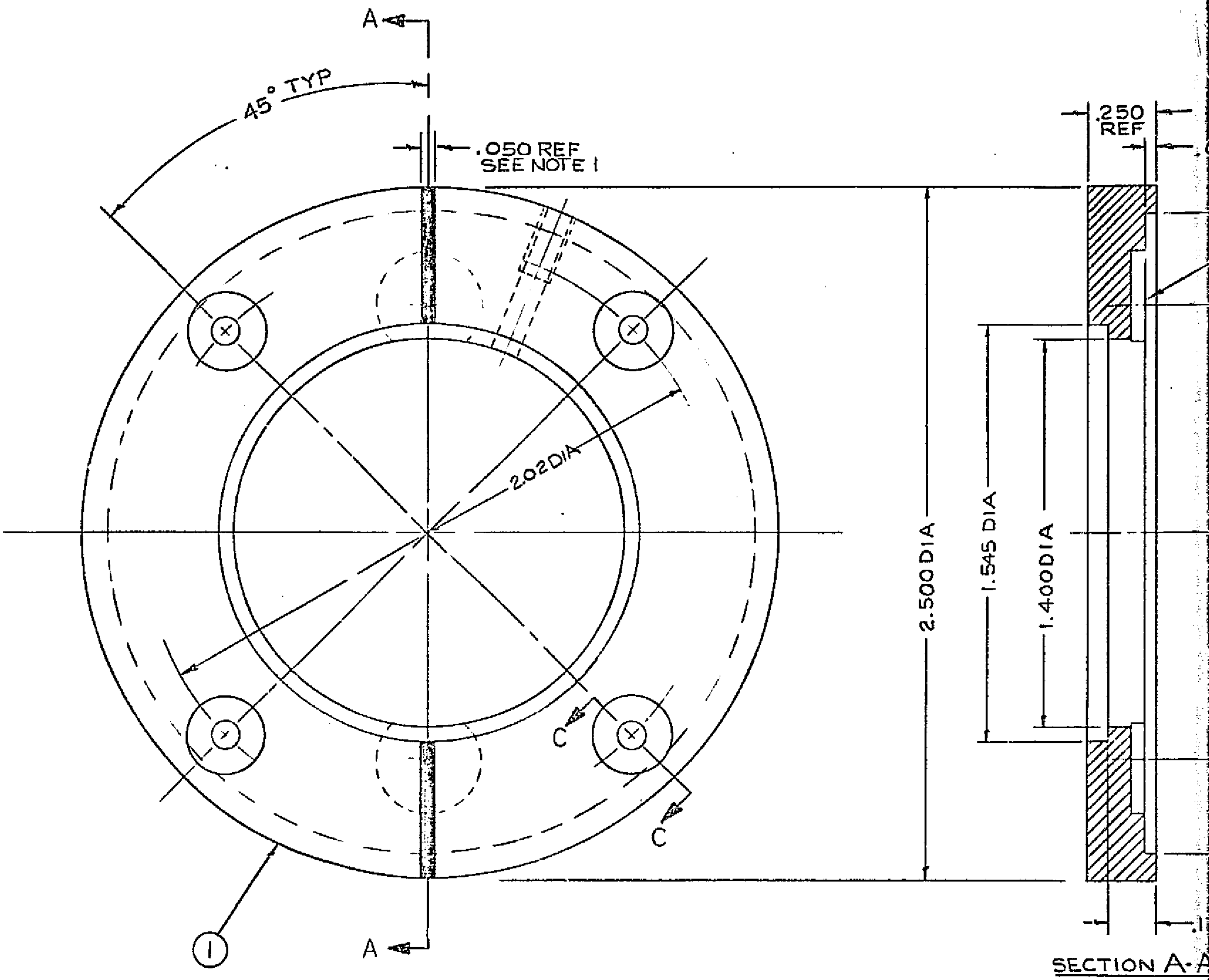

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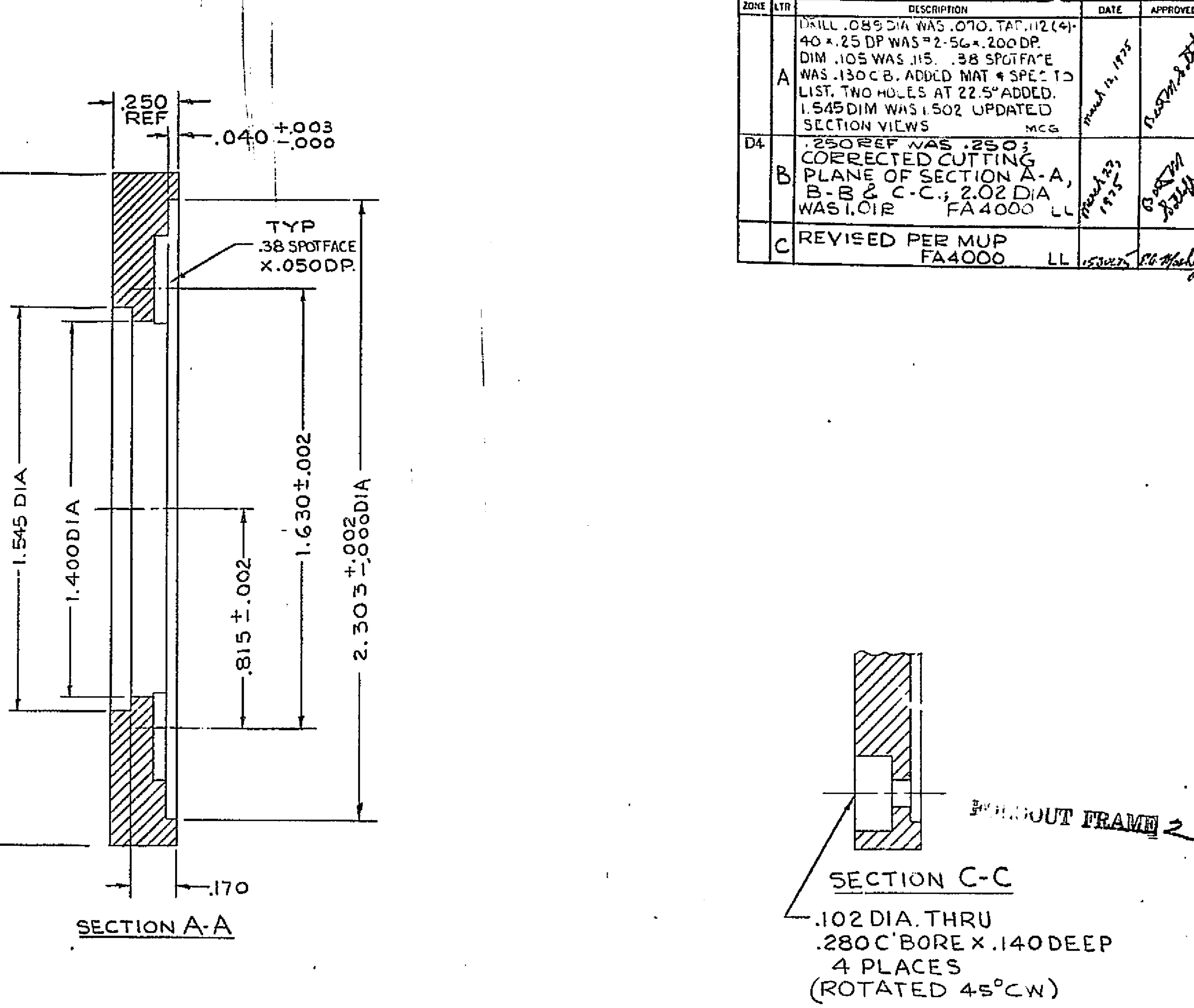

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D4	B	.250 REF WAS .250; CORRECTED CUTTING PLANE OF SECTION A-A, B-B & C-C.; 2.02 DIA WAS 1.01R FA4000 LL	March 27 1975	
	C	REVISED PER MUP FA4000 LL	15 Jul 75	

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				AR		[illegible]995-250	GLASS EPOXY SH., .250 THK	MIL-P-18177C	
				-1					

MATERIALS AND SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED THE SURFACE FINISH OF MACHINED PARTS SHALL NOT EXCEED A MAXIMUM READING 125 PER ANSI STD B46.1 — 1962

INTERPRET DIMENSIONS AND TOLERANCES PER ANSI Y14.5-66

THD DATA TO BE INTERPRETED USING NBS HDBK H28 AND MIL-STD-9

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING

TOLERANCES ON

BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP TO 6	± .02	± .010
ABOVE 6 TO 24	± .03	± .015
ABOVE 24	± .06	± .020

ANGULAR DIMENSIONS ± 1/2°

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FIRST APPLICATION

RCA COMMODITY CODE

CONTRACT NO. NAS 9-13549

DRAWN [illegible] Sept 30 1974

CHECKED [illegible] Oct 1974

DESIGN ACTIVITY APPD.

RCA

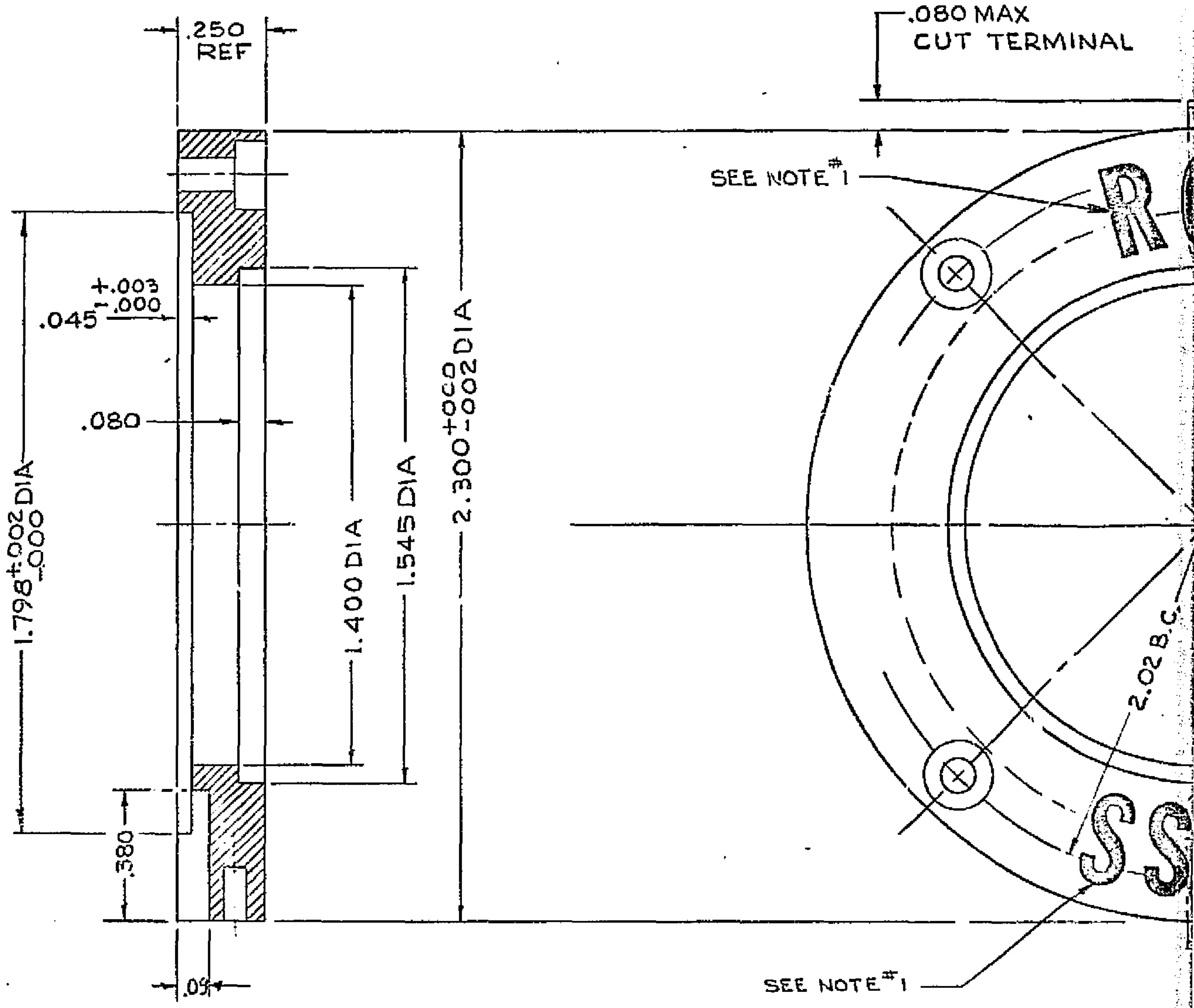
RCA CORPORATION · NEW YORK, NY

ASTRO-ELECTRONICS DIV PRINCETON N.J. PLANT

POLARIZER HOLDER

SIZE D | CODE IDENT NO. 49671 | 5K2283896

SCALE 4/1 | SHEET

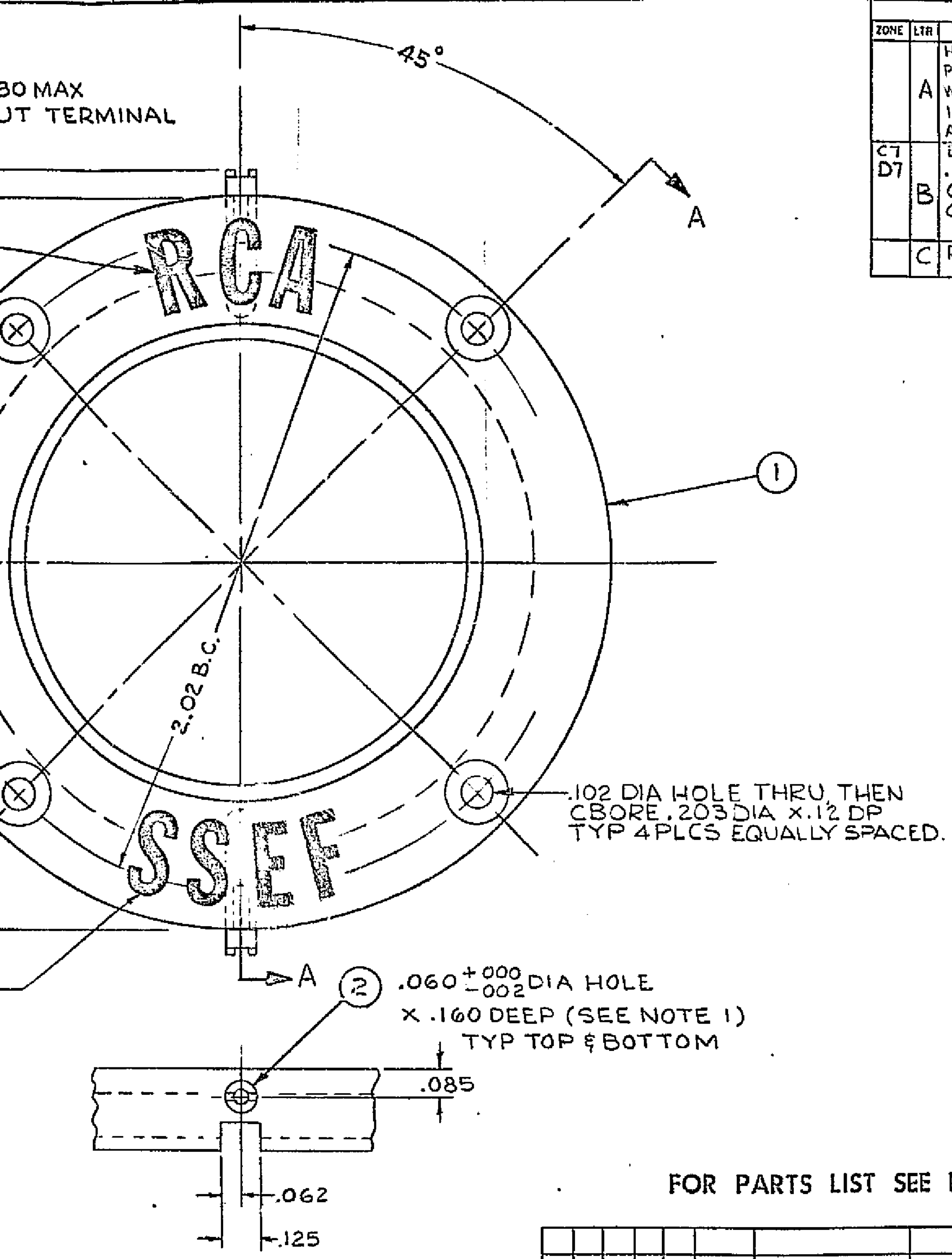


SECTION A-A
SHOWN WITHOUT TERMINAL

NOTES:

1. MARK AS SHOWN WITH .18 HIGH LETTERS USING ITEM 6 PER ITEM 3.
2. TAG OR BAG 49671-SK2283897-501 PER MIL-STD-130.
3. PRESS ITEM 2 INTO ITEM 1 AND SECURE USING ITEM 4 PER ITEM 3.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	HOLE LOCATIONS AT 17° DELETED. PLACED AT 22.5° TYP. .112(4)-40 HOLE WAS #2-56. CHANGED .115 TO .105. 1.510 WAS 1.502. MAT. & SPEC. INFO ADDED. NOTES REVISED. MCG	March 10, 1975	[illegible]
C7 D7	B	DELETED: DIM. .130; .250 REF WAS .250; CORRECTED CUTTING PLANE OF SECTION A-A & B-B SO FA4000 LL	March 27 1975	[illegible]
	C	REVISED PER MUP FA4000 LL	15 JUL 75	[illegible]



FOLDOUT FRAME 2

FOR PARTS LIST SEE PL SK 2283897

				AR		2021037-191	PAINT, BLACK EPOXY		
				X		[illegible]0822	SPEC, WORKMANSHIP		
				AR		2010355-250	GLASS EPOXY SH, .250THK	MIL-P-18177C	
QTY REQD PER DASH NO.				-1	CODE IDENT	IDENTIFYING NO.	DESCRIPTION	SPECIFICATION	SEE NOTE NO.

MATERIALS AND SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED THE SURFACE FINISH OF MACHINED PARTS SHALL NOT EXCEED A MAXIMUM READING 125 PER ANSI STD B46.1 — 1962

INTERPRET DIMENSIONS AND TOLERANCES PER ANSI Y14.5 66

THD DATA TO BE INTERPRETED USING NBS HDBK H28 AND MIL STD 9

2284259-501	SSEF
NEXT ASSY	USED ON

FIRST APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING

TOLERANCES ON		
BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP TO 6	±.02	±.010
ABOVE 6 TO 24	±.03	±.015
ABOVE 24	±.06	±.020
ANGULAR DIMENSIONS ±½°		

RCA COMMODITY CODE

CONTRACT NO. NAS 9-13549 REL

DRAWN [illegible] DATE

CHECKED [illegible] DATE

DESIGN ACTIVITY APPD. DATE

RCA CORPORATION NEW YORK, NY

RCA ASTRO-ELECTRONICS DIV PRINCETON PLANT

ANALYZER HOLDER ASSY

SIZE	CODE IDENT NO.	
D	49671	SK2283897

SCALE 4/1 SHEET 1 OF 1

PARTS LIST

RCA CORPORATION | NEW YORK, NY

ASTRO-ELECTRONICS DIVISION, PRINCETON, N.J

REVISION DATE	PL SK2283897	REV LTR B

LIST TITLE:	PREPARED BY / DATE	REL	CODE IDENT NO.	SHEET 1 OF 2 SHEETS
ANALYZER HOLDER ASSY	R. Hozaleki Oct 11, 1974		49671	
	CHECKED BY / DATE: Lewis E. Bradley Oct. 16, 1974		CONTRACT NO.	
	DESIGN ACTIVITY APPD / DATE: [illegible] 16 Oct 74		NAS 9-13549	

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED	LTR	DESCRIPTION	DATE	APPROVED
A	ADDED ITEM 6. DELETED "SEE NOTE 1" IN ITEM 1 AND DELETED "PASTE" IN ITEM 4. M.C.G.	3/10/75	Berton [illegible]				
B	ITEM 4 PART NO. WAS 1750415. SH 2 WAS LOST & REWRITTEN FA 4000 LL	15 Jue 75	E.A. Mosley				

INTERPRET SYMBOLS USED AS FOLLOWS:

UNITS OF MEASURE (UM)	QUANTITIES	SYMBOL
A — Inches, B — Feet, C — Yards, D — Ounces, E — Pints, F — Quarts, G — Gallons, H — Barrels, J — Pounds, L — Pair, M — Set, N — Kit, P — Roll, R — Box, Case, T — Each	X — Applicable document; O — For ref only	U — Govt or customer furnished; K — Govt or customer furnished and installed; * — Vendor item, See specification or source control drawing.

RCA 2400-3 (8-68) 1107

Parts List Worksheet

RCA Astro Electronics

Next Hi
Shop Or
Contrac

Assembly Number 1—14	PG 15	16—19	20	Rev 21—22	RWK 23	OP 24	25	26—30	Shop Order 31—39	Assemb 40—
SK 2283897			H	B			1		FA 4000	AN

H.G. (2) 16-17	Suf (2) 18-19	20	OP 24	Cd # 25	Item No. (5) 26-30	504 (5) 31-35	503 (5) 36-40	502 (5) 41-45	501 (5) 46-50	Type 51	UM (2) 52-53	Code Ident (5) 54-58	Part or Identifying Number (20) —78	80	Sym 31	Nomenclature or Description (48) 32
		L			1				1				SK2283897-1	1		HOLDER
		L			2				2				1702646-15	1		TERMINAL
		L			3				X				2021037	1		SPEC, MATL
		L			4				AR				2021037-111	1		RED EPOXY
		L			5				X				8030022	1		SPEC, WORK
		L			6				AR				2021037-191	1		PAINT, BLA
		L												1		
		L												1		
		L												1		
		L												1		
		L												1		
		L												1		
		L												1		NOTE:
		L												1		ORIGINAL
		L												1		MISPLACED
		L												1		FROM PRIN
		L												1		
		L												1		
		L												1		
		L												1		
		L												1		
		L												1		
		L												1		
		L												1		
		L												1		

AED 576 7/71 FOLDOUT FRAME 1

Next Higher Assembly No. ______
Shop Order ______
Contract ______

Project ______
Prepared by L. LOY
Checked by ______

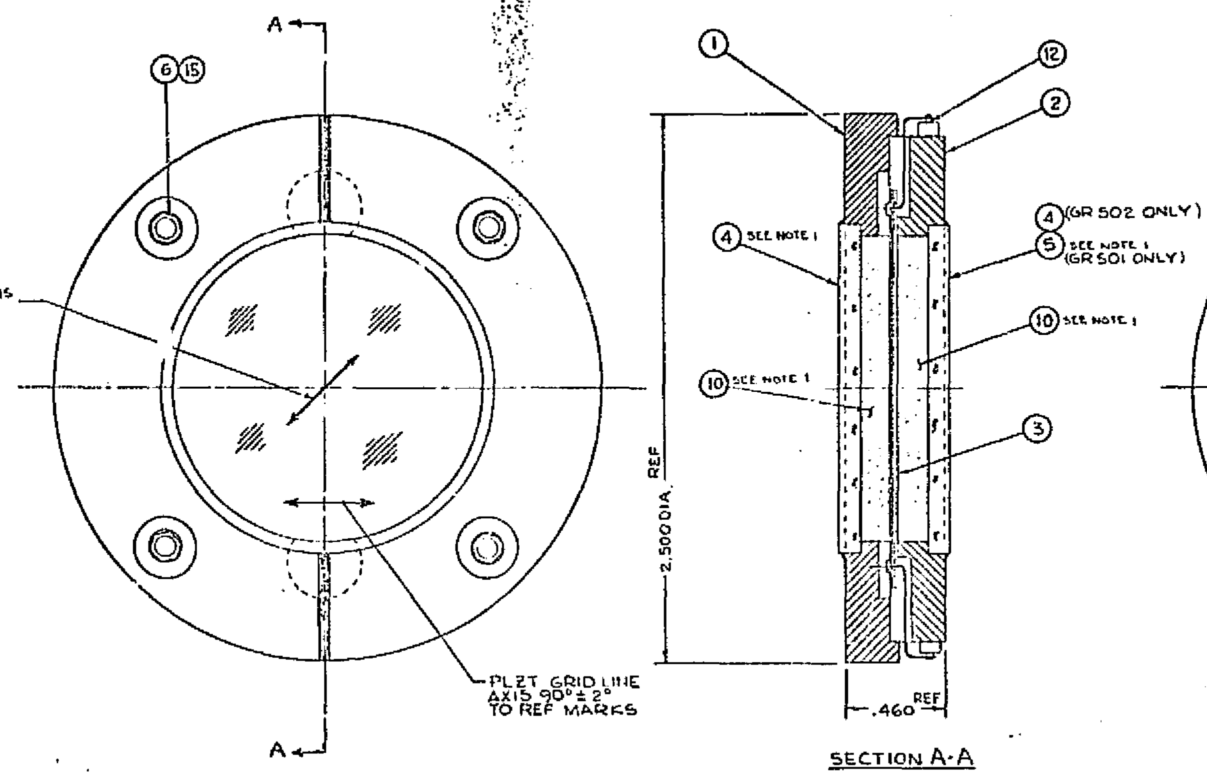
Date 7-15-75
Date ______

...der ... 39	Assembly Title 40 ... 58	PL Number 59 ... 69	70	H.G. 71-72	Dup 73-74	75	Z 76	77 ... 79	80
4000	ANALYZER HOLDER ASSY	PLSK2283897							1

...omenclature or Description
...8)

...2 ... 79	80
...OLDER	2
...ERMINAL	2
...SPEC, MATL APPLICATION	2
...ED EPOXY	2
...SPEC, WORKMANSHIP	2
...PAINT, BLACK EPOXY	2
	2
	2
	2
	2
	2
	2
...NOTE:	2
...RIGINAL SHEET BY HOZALSKI (DATED 10-11-74) WAS	2
...ISPLACED OR LOST. INFORMATION HEREWITH OBTAINED	2
...ROM PRINT SK2283897 REV A.	2
	2
	2
	2
	2
	2
	2
	2
	2
	2

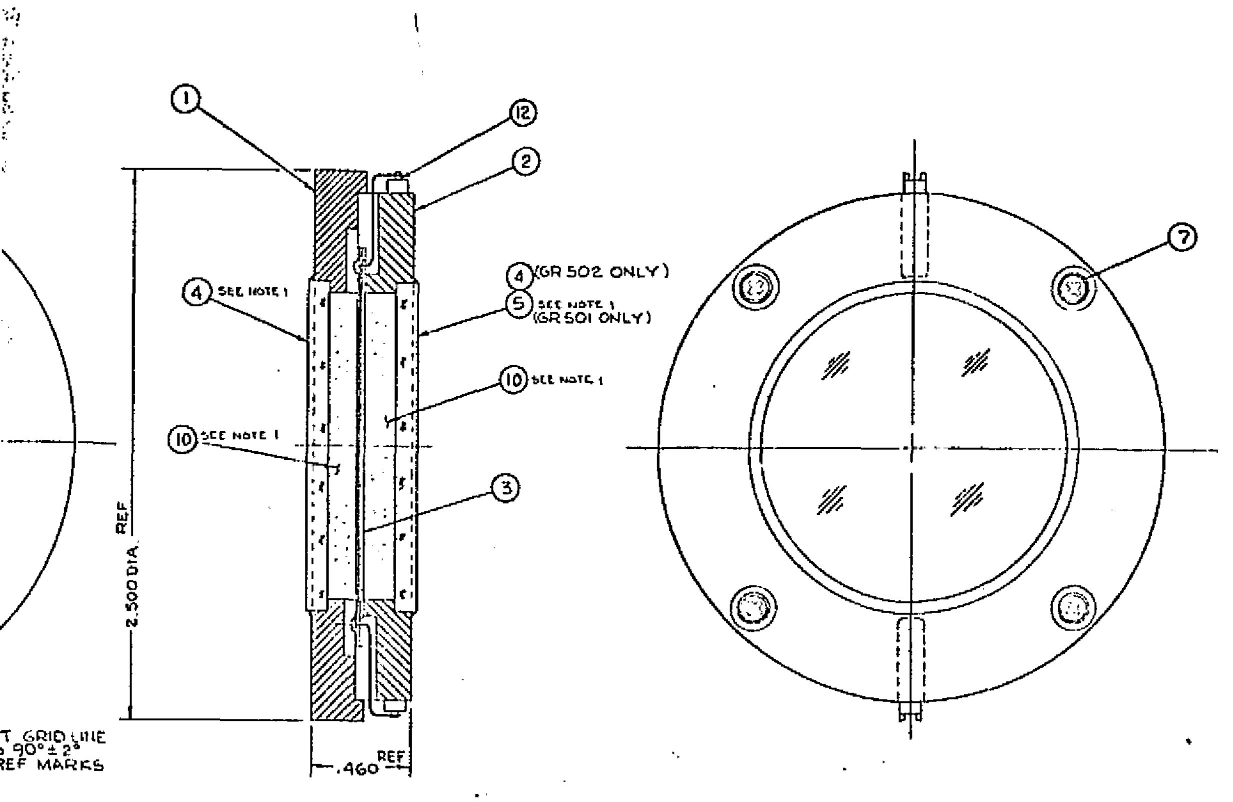
FOLDOUT FRAME



NOTES:
1) ASSEMBLE, POT, & ALIGN PER ITEM 18, ASSEMBLY NOTES.

FOLDOUT FRAME

REV	DESCRIPTION
A	[illegible] ADDED SECTION A-A REVISED
B	REVISED PER MUP FA4000 LL



SECTION A-A

FOR PARTS LIST SEE PL 5K2284259

MATERIALS AND SPECIFICATIONS

NAS 9-13549

RCA

PLZT HOLDER ASSY

E 49671 5K2284259

FOLDOUT FRAME 5

PARTS LIST

RCA

RCA CORPORATION | NEW YORK, NY

ASTRO-ELECTRONICS DIVISION, PRINCETON, N.J

REVISION DATE		REV LTR
	PL SK2284259	B

LIST TITLE:

PLZT

HOLDER ASSEMBLY

PREPARED BY	DATE
R. Hozalchi	Oct 9, 1974
CHECKED BY	DATE
Louis E. Bradley	Oct. 16, 1974
DESIGN ACTIVITY APPD	DATE
D S Wenge	16 OCT 74

REL

CODE IDENT NO. 49671

SHEET 1 OF 2 SHEETS

CONTRACT NO. NAS9-13549

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED	LTR	DESCRIPTION	DATE	APPROVED
A	ITEMS 4,5 AND 7 PART NO. CHG'D. ITEM 6 QUANTITY WAS 2. PART NO. ADDED TO ITEMS 10, 11. ITEMS 14,15,16 AND 17 ADDED. MCG	March 12 1975	Burton Roth				
B	REVISED PER MUP FA4000 LL	15 Jul 75	E.A. Mahay				

INTERPRET SYMBOLS USED AS FOLLOWS:

UNITS OF MEASURE (UM)	QUANTITIES	SYMBOL
A — Inches B — Feet C — Yards D — Ounces E — Pints F — Quarts G — Gallons H — Barrels J — Pounds L — Pair M — Set N — Kit P — Roll R — Box, Case T — Each	X — Applicable document O — For ref only	U — Govt or customer furnished K — Govt or customer furnished and installed * — Vendor item, See specification or source control drawing.

Parts List Worksheet

RCA Astro Electronics

Next Higher Ass
Shop Order
Contract

Assembly Number 1–14	PG 15	16–19	20	Rev 21–22	AWK 23	OP 24	25	26–30	Shop Order 31–39	Assembly Title 40
SK 2284259			H	B			1		FA4000	PLZT

H.G. (2) 16-17	Suf (2) 18-19	20	OP 24	Cd # 25	Item No. (5) 26-30	504 (5) 31-35	503 (5) 36-40	502 (5) 41-45	501 (5) 46-50	Type 51	UM (2) 52-53	Code Ident (5) 54-58	Part or Identifying Number (20) –78	80	Sym 31	Nomenclature or Description (48) 32
		L	P	1	1			1	1				SK 2283896-1	1		POLARIZER HO
		L			2			1	1				SK 2283897-501	1		ANALYZER HOL
		L			3			1	1				SK 2282386-501	1		PLZT ASSEMBL
		L			4			2	1			82590	SEE DESCRIP	1		POLARIZER, 40
		L			5			–	1			97197	2184	1		GLASS, COVER
		L			6			4	4				NAS1291C02M	1		NUT, #2-56
		L			7			4	4				NAS1635-02-8	1		SCREW, #2-56
		L			8			–						1		
		L			9			–						1		
		L			10			AR	AR			96717	2260977-1	1		ENCAPSULANT
		L			11			AR	AR				2021037-1	1		STAKING MATL
		L			12			AR	AR				2010858-1	1		SOLDER
		L			13			X	X				8030022	1		SPEC WORKMA
		L			14			AR	AR			96717	99354-178	1		PRIMER, SYLG
		L			15			4	4				8924401-2	1		WASHER, FLAT
		L			16			X	X				2021037	1		SPEC, MATL AP
		L			17			O	O			97197	41694	1		POLARIZED AX
		L			18			X	X				SK2285131	1		NOTES, PLZT H
		L												1		
		L												1		
		L												1		
		L												1		
		L												1		
		L												1		
		L												1		

ED 576 7/71 FOLDOUT FRAME

Next Higher Assembly No. ____
Shop Order ____
Contract ____

Project ____
Prepared by HOZALSKI
Checked by ____

Date 10-1-74
Date ____

der 39	Assembly Title 40 — 58	PL Number 59 — 69	70	H.G. 71-72	Dup 73-74	75	Z 76	77 79	80
4000	PLZT HOLDER ASSY	SK2284259							1

lomenclature or Description 48) 2	79 80
POLARIZER HOLDER	2
ANALYZER HOLDER	2
PLZT ASSEMBLY	2
POLARIZER, 40.5 MM, "VIVITAR"	2
GLASS, COVER	2
NUT, #2-56	2
SCREW, #2-56	2
	2
	2
ENCAPSULANT DOW 93-500	2
STAKING MATL	2
SOLDER	2
SPEC. WORKMANSHIP	2
PRIMER, SYLGARD, (DOW)	2
WASHER, FLAT	2
SPEC, MATL APPLICATION	2
POLARIZED AXIS FINDER	2
NOTES, PLZT HOLDER ASSY	2
	2
	2
	2
	2
	2
	2
	2

FOLDOUT FRAME 2

Next Assembly	Used On	Revisions				Rev
	SSEF	Ltr	Description	Date	Approved	
First Application						

Revision Record Continued on Sheet

	Contract No. NAS 9-13549	RCA	RCA Corporation Astro-Electronics Division Princeton, New Jersey
	Written E. A. MOSHEY Date 11 JUL 75	NOTES - PLZT HOLDER ASSEMBLY	
	Approved [signature] Date 11 JUL 75		
	Approved Date	Size A	Code Ident No. 49671	SK-2285131
			Sheet 1 of 2

AED-869 5/70

NOTES - PLZT HOLDER ASSEMBLY

1. Remove and discard mounting ring from Item 4.

2. Clean Items 1, 2, 3, 4 and 5 using a chlorothene flush, dry with nitrogen gas. Then flush with freon-TF, dry with nitrogen gas. All parts should be stored in equally clean containers until ready for use.

3. Perform all bonding in a clean room environment or in a laminar flow work station Class 100.

4. Bond the PLZT ceramic and support ring (Item 3) to the analyzer holder (Item 2) by applying a light bead of Item-11 continuously around the analyzer holder mounting area. Carefully seat the PLZT assembly allowing the wires to rest in the wells. Pot the wells with Item-11 (DO NOT FILL ABOVE TOP SURFACE).

5. Apply a continuous bead of Item 11 to the polarizer holder's (Item 1) mating surface. Bolt the polarizer holder to the analyzer holder and apply a bead of Item 11 to the O.D. Seam. Cure the assembly at 140°F (60°C) for 4 hours.

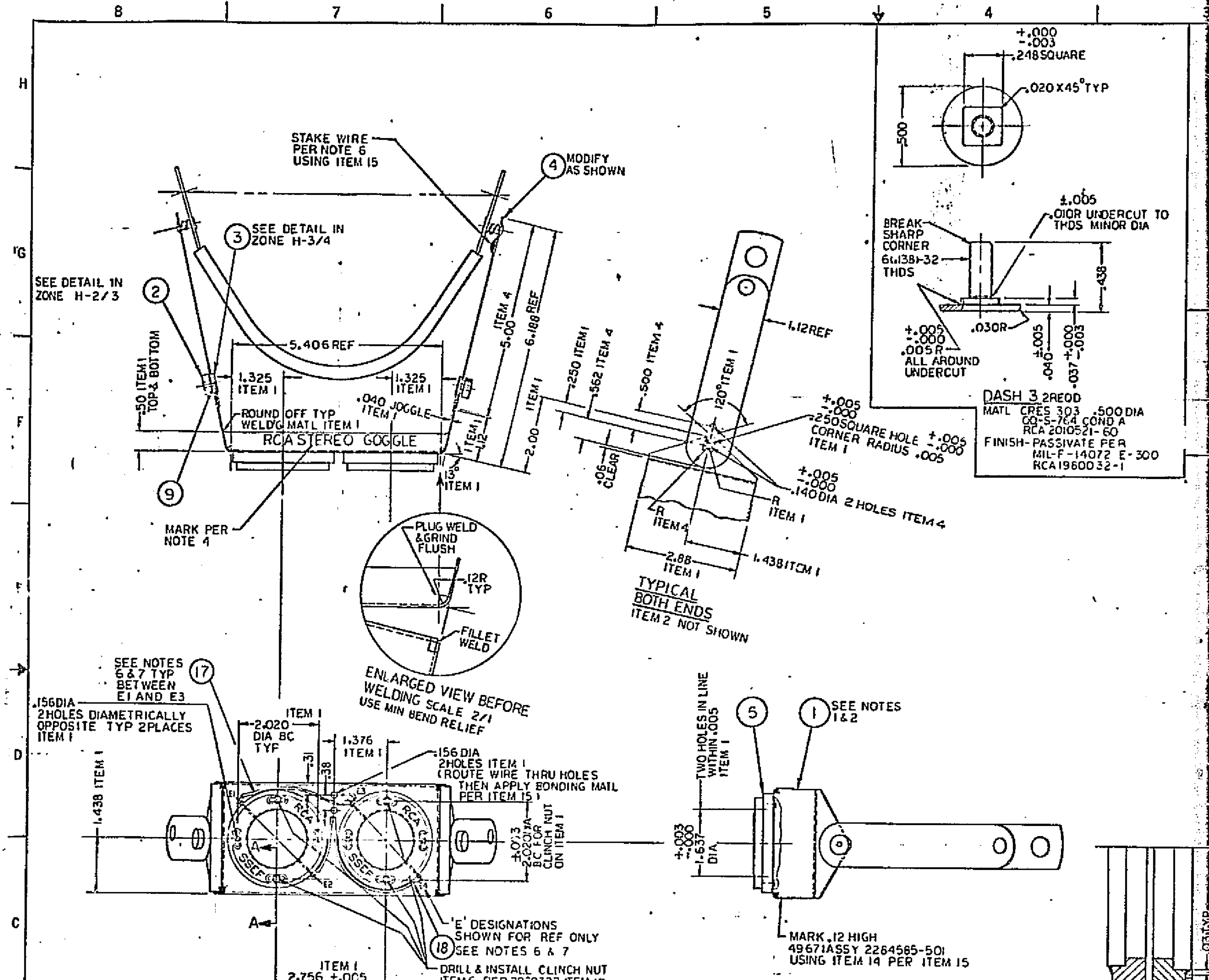
6. Apply a very thin coat of primer (Item 14) to one side of the PLZT by use of an air brush. Allow to dry one hour. Pot using encapsulant Item 10 filling well 3/4 full. Cure 4 hours at 140°F (60°C).

7. Repeat Step 6 for the other side of the PLZT.

8. Prime polarizer (Item 4) (one side only) with Item 14 using an air brush. Allow to dry one hour.

9. Fill polarizer holder to the top of the lower well using Item 10. Place polarizer in well primed side down seating one edge first then allowing the polarizer to slowly contact the encapsulant (allow no trapped air). Use the axis finder (Item 17) to locate polarization axis and align as per Sheet 1. (Axis must be at 45° ±2° to ref. marks). Place an 8 oz. (227 gm) weight on polarizer and cure at 140°F (60°C) for 4 hours.

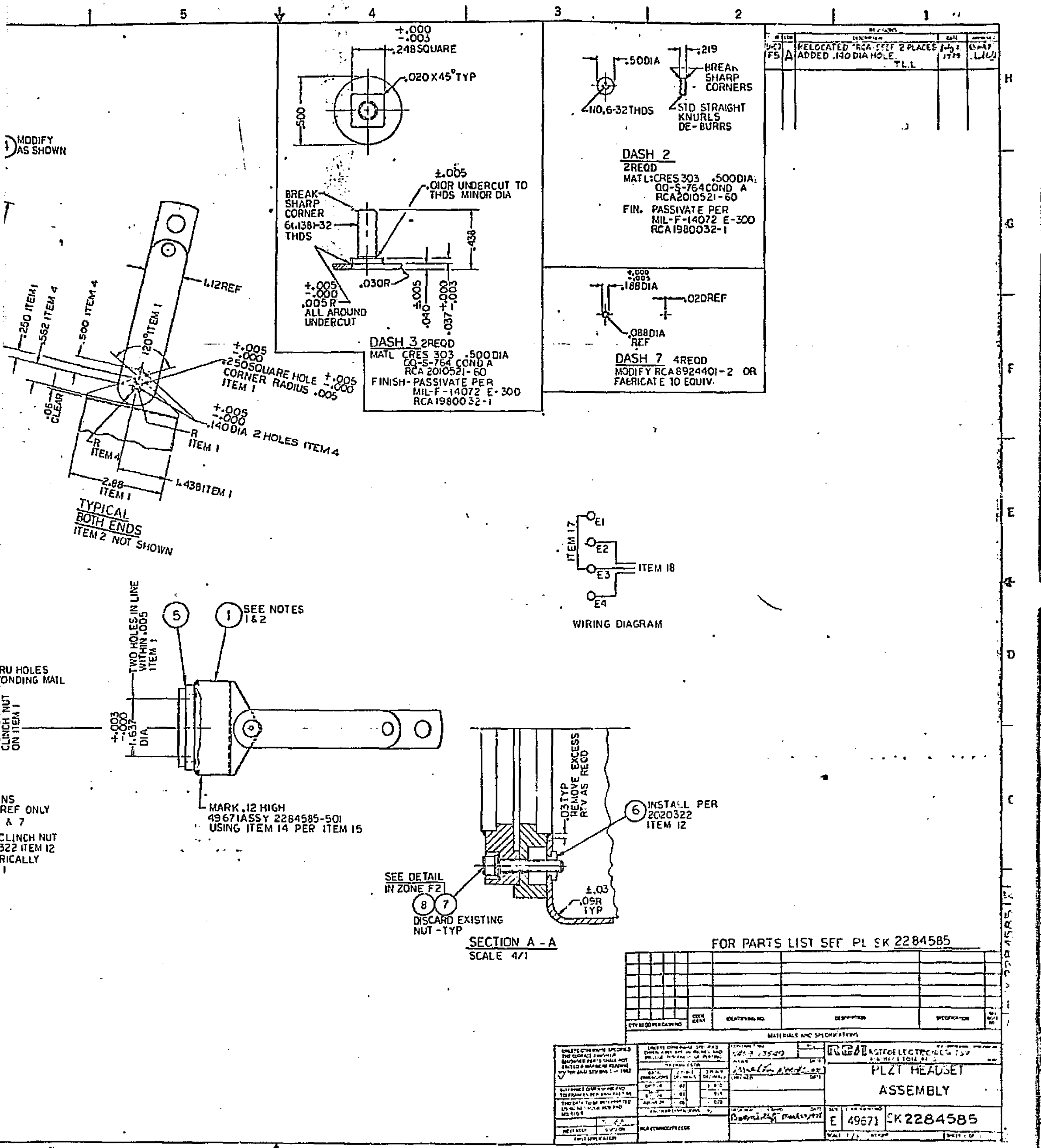
10. Repeat Step 9 for the other side. When Item 4 is called out (-502) it must be aligned so that its polarization axis is crossed with the other polarizer. (Set for minimum light transmission). When Item 5 is called out (-501) no alignment is necessary.



NOTES

1- MATL OF ITEM I
AL ALY 6061 T4 QQ-A-250/11C
.040 THK RCA 2010590-440.
2- FINISH OF ITEM I (MASK THDS OF ITEM 6)
BLACK ANODIZE PER MIL-A-8625 TYPE II CLASS 2
RCA 1980039-1.
3- ALL WELDINGS TO BE CONTINUOUS AND PER SPEC 2020247, ITEM 11 THEN GRIND FLUSH OR BLEND IN SMOOTHLY WITH ADJACENT SURFACE.
4- MARK IN APPROX LOCATION SHOWN WITH .25 HIGH STD CHARACTERS USING ITEM 14 PER ITEM 15.
5- COAT TERMINALS PER 2021037, ITEM 15 AFTER WIRING HOOK-UP.
6- TACK LEADS PER 2021037 ITEM 15 TO ITEM I & 4. ALLOW FLEX FOR ADJUSTMENT BETWEEN ITEM I & 4.
7- CAUTION: USE EXTREME CARE IN HANDLING AND FITTING ITEM 5. DELICATE OPTICAL ELEMENTS. USE AMBIENT ROOM TEMPERATURE TO CURE TACK BONDS & TERMINAL COATING.

FOLDOUT FRAME



FOLDOUT FRAME 2

PARTS LIST

RCA

RCA CORPORATION | NEW YORK, NY

ASTRO-ELECTRONICS DIVISION, PRINCETON, N.J

REVISION DATE	
PL	SK2284585
REV LTR	

LIST TITLE: PLZT HEADSET ASSEMBLY	PREPARED BY Leewah Loy — DATE March 26, 1975	REL	CODE IDENT NO. 49671 — SHEET 1 OF SHEETS
	CHECKED BY — DATE		CONTRACT NO. NAS 9-13549
	DESIGN ACTIVITY APPD — DATE Bert M Gottlieb March 27, 75		

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED	LTR	DESCRIPTION	DATE	APPROVED

INTERPRET SYMBOLS USED AS FOLLOWS:

UNITS OF MEASURE (UM)	QUANTITIES	SYMBOL
A — Inches, B — Feet, C — Yards, D — Ounces, E — Pints, F — Quarts, G — Gallons, H — Barrels, J — Pounds, L — Pair, M — Set, N — Kit, P — Roll, R — Box, Case, T — Each	X — Applicable document; O — For ref only	U — Govt or customer furnished; K — Govt or customer furnished and installed; * — Vendor item, See specification or source control drawing.

Parts List Worksheet

Astro Electronics

Assembly Number	Rev		PL Number	
SK2284585	—	1	PLZT HEADSET ASSY SK2284585	1

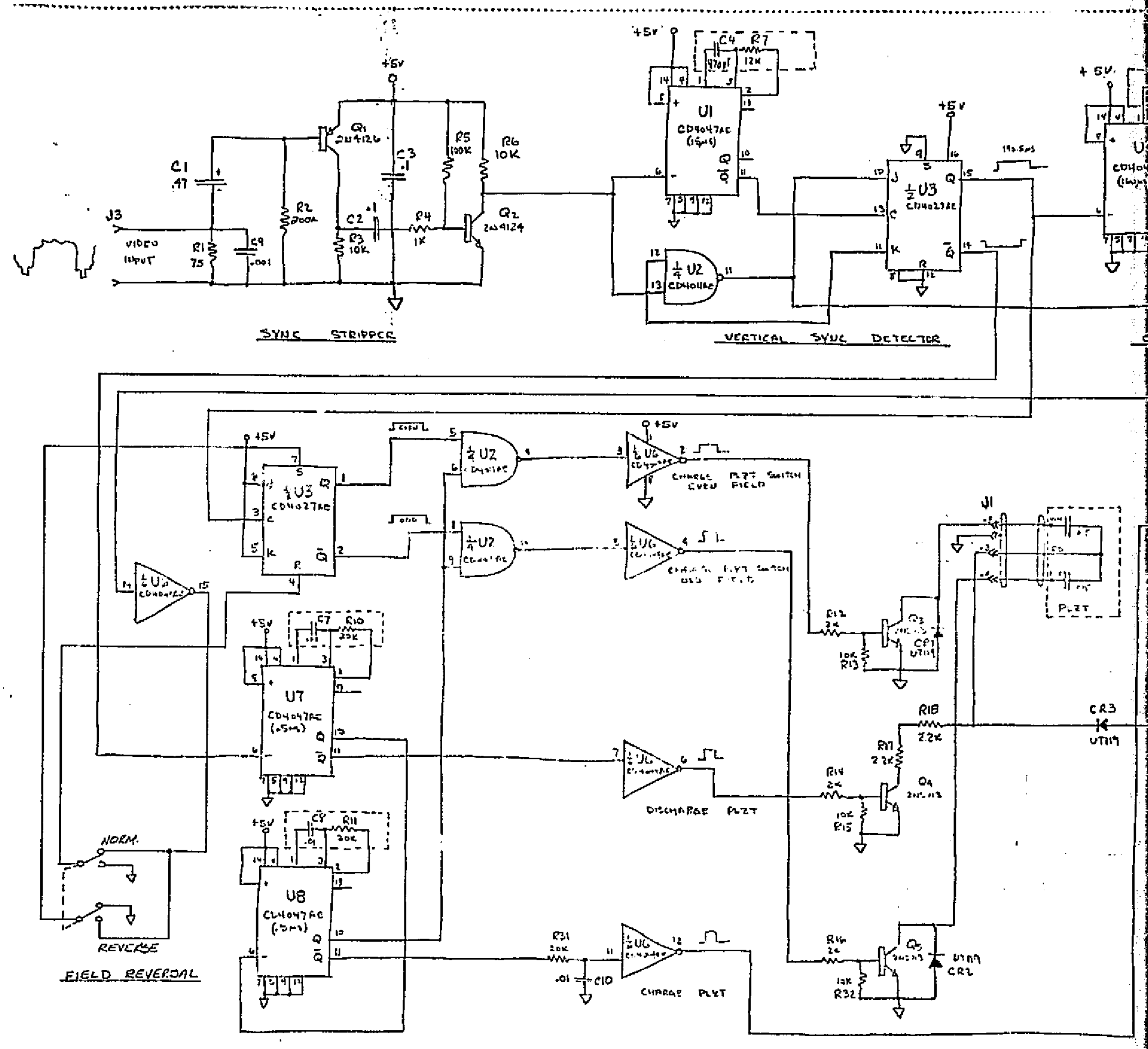
Code (20)	Item No.	Qty Req'd 504	503	502	501	Code Ident	Identifying Number		Nomenclature or Description	
L	1				1		2284585-1	1	FRAME, ADAPTER (SEE NOTES 1 & 2 ON DWG)	2
L	2				2		2284585-2	1	NUT, KNURLED (SEE DETAIL ON DWG ZONE H-2/3)	2
L	3				2		2284585-3	1	STUD, PIVOT (SEE DETAIL ON DWG ZONE H-3/4)	2
L	4				1	97197	70699	1	HEAD-SET (COMMERCIAL PART-[illegible]), MODIFY	2
L	5				2		SK2284259-501	1	PLZT HOLDER ASSY	2
L	6				4		486067-5	1	CLINCH NUT 2-56	2
L	7				4		8924401-2	1	WASHER (MODIFY PER DETAIL ON DWG ZONE F-2/3)	2
L	8				4		NAS1640-2	1	LWASHER NO. 2	2
L	9				2		8924401-4	1	WASHER, FLAT NO. 6	2
L	10				X		1980039-1	1	FINISH, BLACK ANODIZE (SEE NOTE 2 ON DWG)	2
L	11				X		2020247	1	SPEC, WELDING AL ALY (SEE NOTE 3 ON DWG)	2
L	12				X		2020322	1	SPEC, CLINCH NUT INSTALLATION	2
L	13				X		1980032-1	1	FINISH FOR DASH 2 & 3	2
L	14				AR		2021037-101	1	PAINT, WHITE EPOXY	2
L	15				X		2021037	1	SPEC, MATL APPLICATION	2
L	16				X		8030022	1	WORKMANSHIP	2
L	17				AR		1970930-29	1	WIRE, HOOK-UP 24 AWG	2
L	18				AR			1	WIRE SPECIAL	2
L								1		2
L								1		2
L								1		2
L								1		2
L								1		2
L								1		2
L								1		2

AED 616 7/71

ORIGINAL PAGE IS OF POOR QUALITY

8 | 7 | 6 | 5

DASH NO.	SPECIFICATION TABLE		
	MATERIAL	FINISH	SPECIFICATION

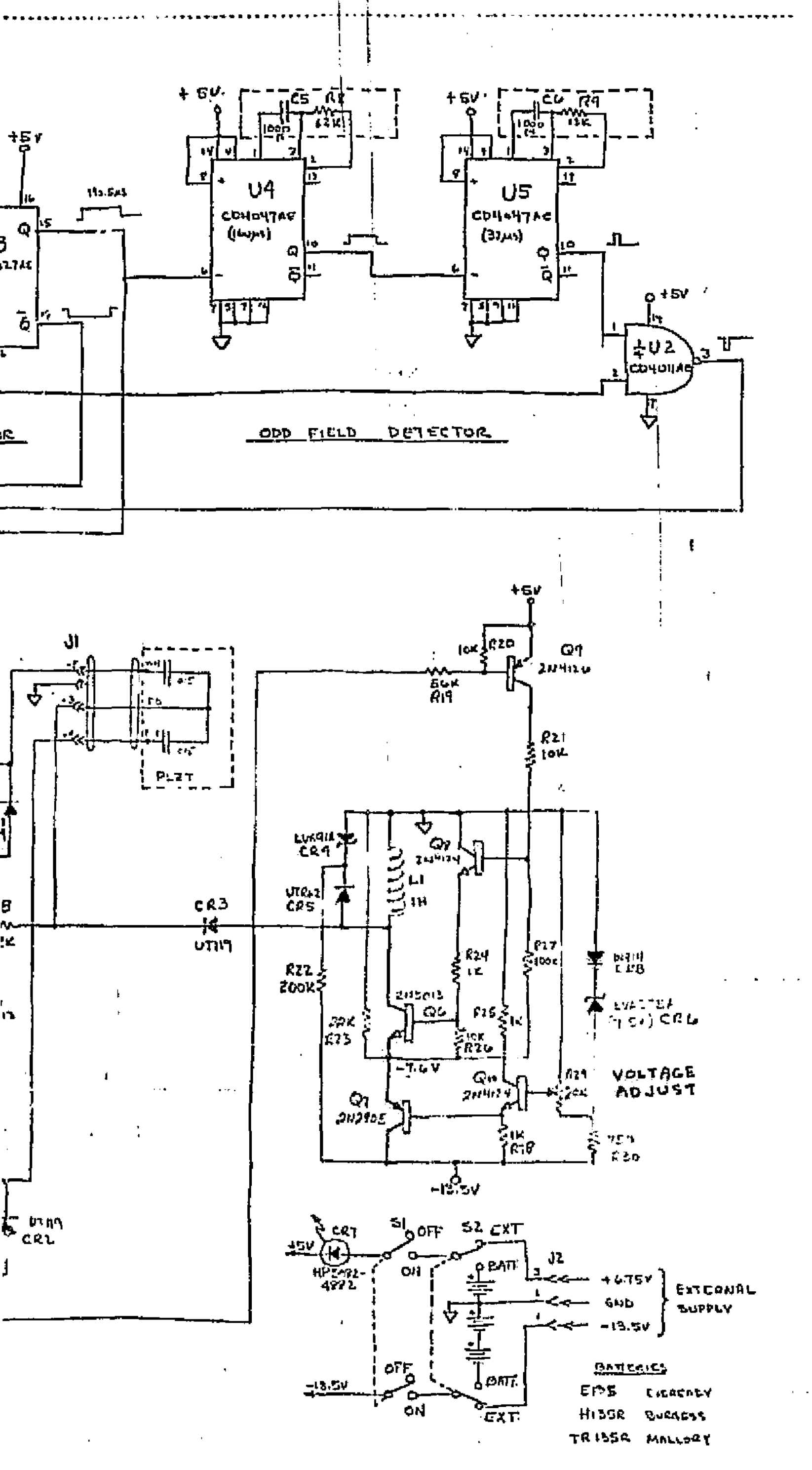


THIS DATA TO BE INTERPRETED USING HNDBK H28 AND MIL-STD-9	SECURIT
RCA COMMODITY CODE	

DOUT FRAME

AED 739-3 3/66

4 | 3 | 2 | 1



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

FOR REVISIONS ONLY

FOLDOUT FRAME 2

SKETCH

... BE INTERPRETED USING ... ND MIL-STD-9	SECURITY CLASSIFICATION	UNLESS OTHERWISE SPECIFIED THE SURF. FIN. OF MACHINED PARTS SHALL NOT EXCEED A MAX READING OF 125 PER MIL-STD-10	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING
		DIMENSIONS AND TOLERANCES PER MIL-STD-8	
...ITY CODE		NEXT ASSY / USED ON	MATERIAL
		FIRST APPLICATION	

TOLERANCES ON		
BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP TO 6	± .02	± .005
ABOVE 6 TO 24	± .03	± .010
ABOVE 24	± .06	± .015
ANGULAR DIMENSIONS ± 1/2°		

CONTRACT NO. NAS 9-13549

SHOP ORDER NO. FA 4000

DRAWN BY M. KRAVITZ DATE 2/12/75

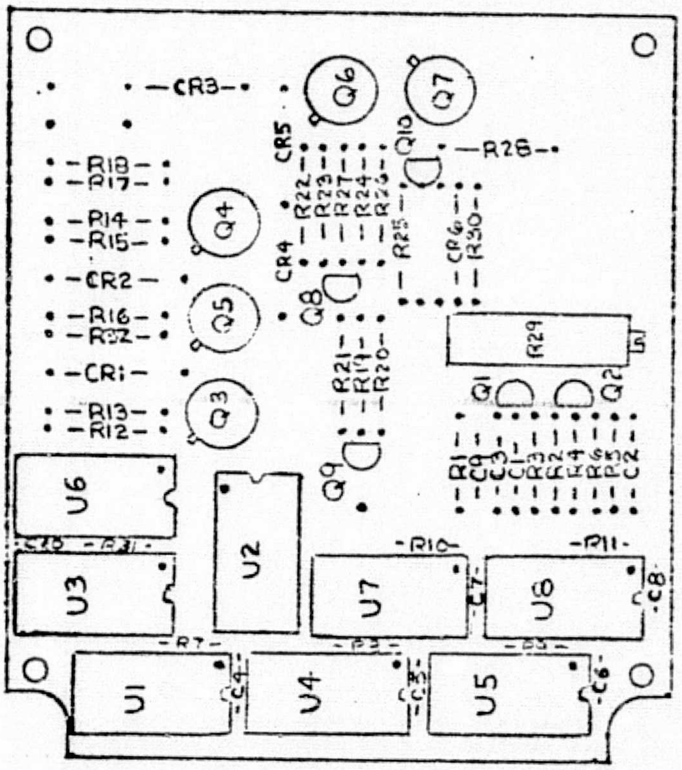
DESIGN ACTIVITY APPD. Bentry Saitoff DATE 2/7/75

RADIO CORPORATION OF AMERICA
NEW YORK, N.Y.
ASTRO-ELECTRONICS DIVISION, PRINCETON, N.J., PLANT

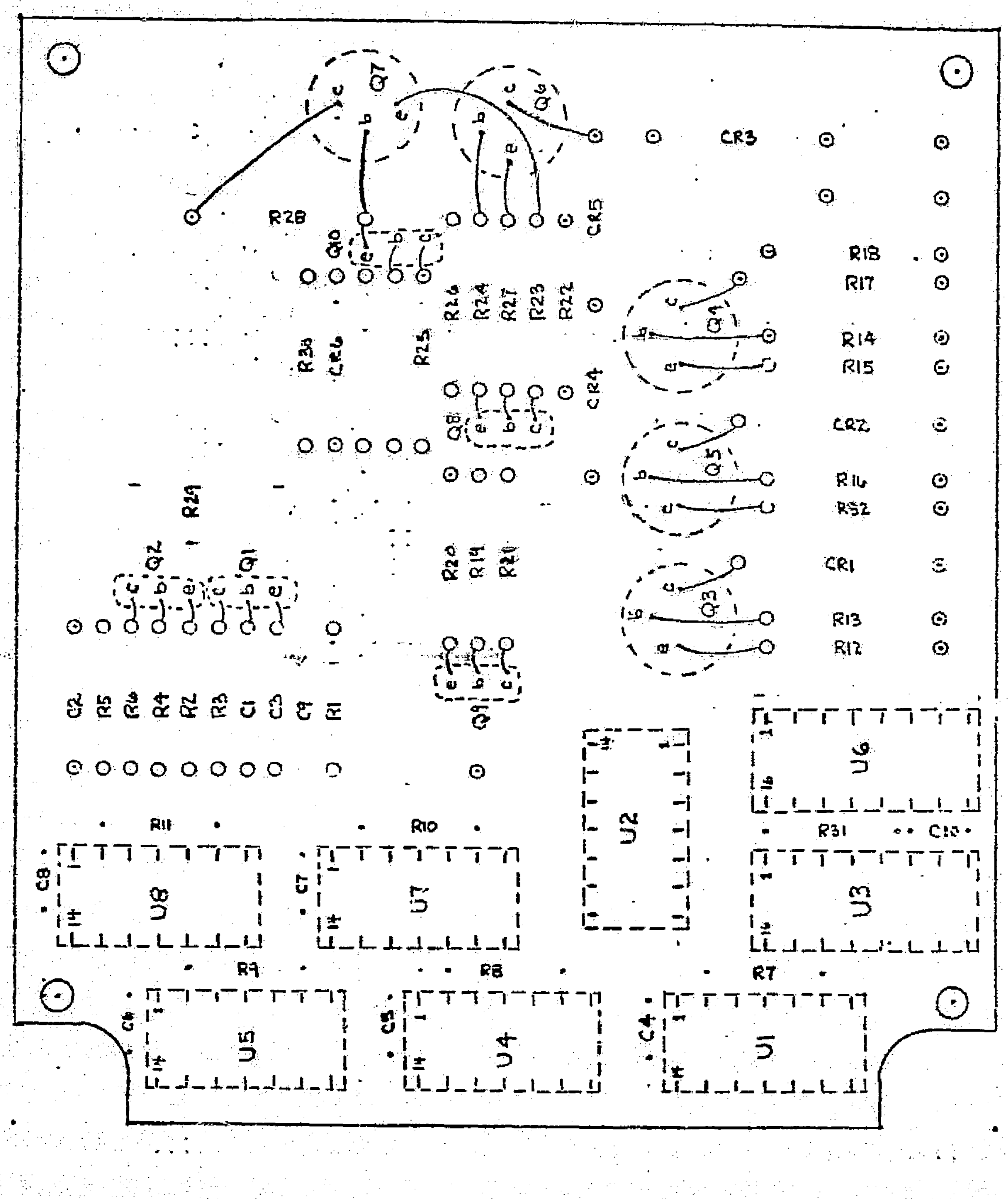
SCHEMATIC, STEREO TV ELECTRONICS

SIZE	CODE IDENT NO.	
D	49671	SK 2288251

SCALE ~ WEIGHT ~ SHEET 1



	DATE		
DRAWN R. Hetherington	3-3-75	STEREO ELECTRONICS LAYOUT (TOP VIEW)	TITLE SOLID STATE ELECTRONIC FILTER
CHECKED			DRAWING NO.
APPROVED			



	DATE		
DRAWN R. Hetherington	3-3-75	STEREO ELECTRONICS LAYOUT (BOTTOM VIEW)	TITLE SOLID STATE ELECTRONIC FILTER
CHECKED			DRAWING NO.
APPROVED			

SHEET 1 OF 4

Parts List Worksheet

RCA Astro Electronics

Project SSGE
Prepared by
Checked by
Date
Date

Next Higher Assembly No.
Shop Order
Contract

Assembly Number (1–14)	P G (15)	16–19	20	Rev (21–22)	23	24	25	26–30	Shop Order (31–39)	Assembly Title (40–58)	PL Number (59–69)	70	H.G. (71–72)	Dup (73–74)	75	76	77–79	80
			H				1			STEREO GOGGLE ELECTRONICS								1

H.G. (2) 16-17	Suf (2) 18-19	20	24	25	Item No. (6) 25-30	Quantity Required 504 (5) 31-35	503 (5) 36-40	502 (5) 41-45	501 (5) 46-50	51	52-53	Code Ident (5) 54-58	Part or Identifying Number (20) –78	80	Sym 31	Nomenclature or Description (40) 32–79	80
		L							/			C1	8412778-39	1	*	CAPACITOR .47 MF	2
		L							/			C2	CK06BX104K	1		.1 MF	2
		L							/			C3	CK06BX104K	1		.1 MF	2
		L							/			C4	CK05BX471K	1		470 PF	2
		L							/			C5	CK06BX102K	1		1000 PF	2
		L							/			C6	CK06BX102K	1		1000 PF	2
		L							/			C7	CK06BX103K	1		.01 MF	2
		L							/			C8	CK06BX103K	1		.01 MF	2
		L							/			C9	CK05BX102K	1		1000 PF	2
		L							/			C10	CK06BX103K	1		.01 MF	2
		L												1			2
		L							/			CR1	UT119	1		DIODE 200V	2
		L							/			CR2	UT119	1		200V	2
		L							/			CR3	UT119	1		200V	2
		L							/			CR4	LVA91A	1		ZENER 9.1V	2
		L							/			CR5	UTR62	1		600V	2
		L							/			CR6	LVA375A	1		ZENER 7.5V	2
		L							/			CR7	HP5082-4882	1		LED	2
		L												1			2
		L							/			J1	274-003	1		CONNECTOR JACK DIN TYPE [illegible]	2
		L							/			J2	274-004	1		[illegible]	2
		L							/			J3	UG-1094/U	1		[illegible] BNC	2
		L												1			2
		L							/			P1	274-005	1		CONNECTOR PLUG DIN TYPE [illegible]	2
		L							/			P2	274-005	1		[illegible]	2

Parts List Worksheet

RCA Astro Electronics

Next Higher Assembly No.	
Shop Order	
Contract	
Project	
Prepared by	Date
Checked by	Date

*Assembly Number 1–14	P G 15	16–19	20	Rev 21–22	23	24	25	26–30	Shop Order 31–39	Assembly Title 40–58	PL Number 59–69	70	H.G. 71–72	Dup 73–74	75	76	77–79	80
			H				1			STEREO GOGGLE ELECTRONICS								1

H.G. (2) 16–17	Suf (2) 18–19	20	24	25	Item No. (5) 26–30	Qty 504 (5) 31–35	503 (5) 36–40	502 (5) 41–45	501 (5) 46–50	51	U/M (2) 52–53	Code Ident (5) 54–59	Part or Identifying Number (20) –76	80	Sym 31	Nomenclature or Description (40) 32–79	80
		L										L1	U54-15	1		INDUCTOR 1 HENRY TOROTEL	2
		L												1			2
		L										Q1	2N4126	1		TRANSISTOR PNP " "	2
		L										Q2	2N4124	1		NPN " "	2
		L										Q3	2N5013	1		NPN " "	2
		L										Q4	2N5013	1		NPN " "	2
		L										Q5	2N5013	1		NPN " "	2
		L										Q6	2N5013	1		NPN " "	2
		L										Q7	2N2905	1		PNP " "	2
		L										Q8	2N4124	1		NPN " "	2
		L										Q9	2N4126	1		PNP " "	2
		L										Q10	2N4124	1		NPN " "	2
		L												1			2
		L												1			2
		L										R1	RC07GF750J	1		RESISTOR 75	2
		L										R2	RC07GF202J	1		[illegible]	2
		L										R3	RC07GF103J	1		[illegible]	2
		L										R4	RC07GF102J	1		[illegible]	2
		L										R5	RC07GF104J	1		[illegible]	2
		L										R6	RC07GF103J	1		[illegible]	2
		L										R7	RC07GF123J	1		[illegible]	2
		L										R8	RC07GF623J	1		[illegible]	2
		L										R9	RC07GF133J	1		13K	2
		L										R10	RC07GF203J	1		20K	2
		L												1			2

Parts List Worksheet

RCA Astro Electronics

Next Higher Assembly No. ______
Shop Order ______
Contract ______

Project ______
Prepared by ______ Date ______
Checked by ______ Date ______

Assembly Number (1–14)	PG (15)	16–19	20	Rev (21–22)	WWP (23, 24)	25	26–30	Shop Order (31–39)	Assembly Title (40–58)	PL Number (59–69)	70	H.G (71–72)	Dup (73–74)	75	Z (76)	77–79	80
			H			1			STEREO GOGGLE ELECTRONICS								1

N.G. (2) 16–17	Suf (2) 18–19	20	24	25	Item No. (5) 26–30	Quantity Required 504 (5) 31–35	503 (5) 36–40	502 (5) 41–45	501 (5) 46–50	51	Cat (2) 52–53	Code Ident (5) 54–58	Part or Identifying Number (20) 59–78	80	31	Nomenclature / Description (40) 32–79	80
		L										R11	RC07GF203J	1		RESISTOR [illegible]	2
		L										R12	RC07GF202J	1		[illegible]	2
		L										R13	RC07GF103J	1		[illegible]	2
		L										[illegible]	RC07GF202J	1		[illegible]	2
		L										[illegible]	RC07GF103J	1		[illegible]	2
		L										[illegible]	RC07GF202J	1		[illegible]	2
		L										R17	R07GF222J	1		[illegible]	2
		L										R?7	RC07GF222J	1		[illegible]	2
		L										[illegible]	RC07GF563J	1		[illegible]	2
		L										R20	RC07GF103J	1		[illegible]	2
		L										R21	RC07GF103J	1		[illegible]	2
		L										R22	RC07GF204J	1		[illegible]	2
		L										R23	RC07GF223J	1		[illegible]	2
		L										R24	RC07GF102J	1		[illegible]	2
		L										R25	RC07GF102J	1		[illegible]	2
		L										R26	RC07GF103J	1		[illegible]	2
		L										R27	RC07GF104J	1		[illegible]	2
		L										R28	RC07GF102J	1		[illegible]	2
		L										R29		1		20K POT	2
		L										R30	RC07GF751J	1		[illegible]	2
		L										R31	RC07GF203J	1		[illegible]	2
		L										R32	RC07GF103J	1		[illegible]	2
		L												1			2
		L												1			2
		L												1			2

Parts List Worksheet

RCA Astro Electronics

Next Higher Assembly No. ____
Shop Order ____
Contract ____

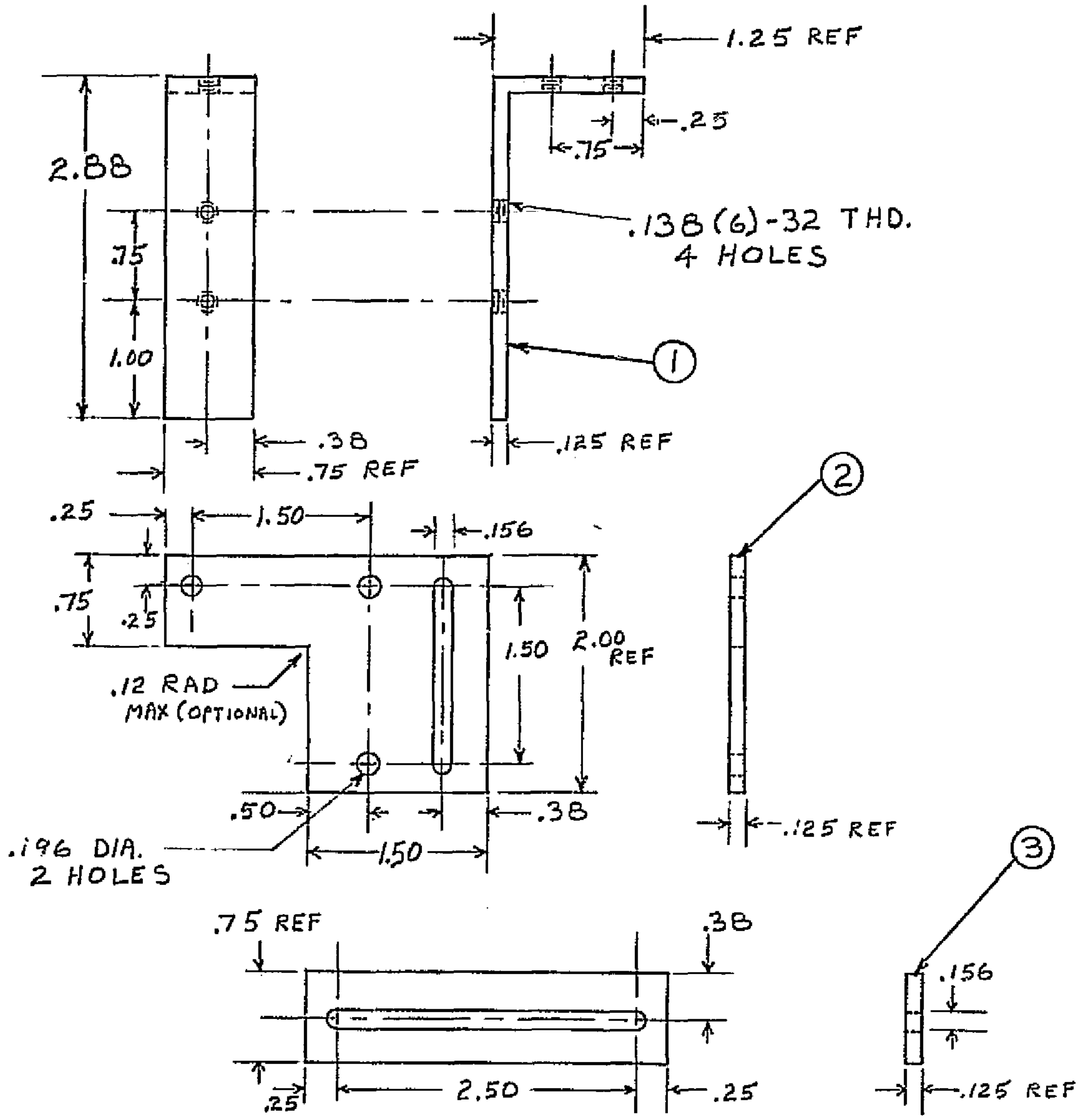
Project ____
Prepared by ____ Date ____
Checked by ____ Date ____

Assembly Number (1–14)	PG (15)	16–19 / 20	Rev (21–22) / RWP (23–24) / 25	26–30	Shop Order (31–39)	Assembly Title (40–58)	PL Number (59–69)	70 / H.G. (71–72) / Dup (73–74) / 75 / Z (76) / 77–79	80
		11	1			STEREO GOGGLE ELECTRONICS			1

H.G. (2) 16-17	Suf (2) 18-19	20	P 24	C d # 25	Item No. (5) 26-30	504 (5) 31-35	503 (5) 36-40	502 (5) 41-45	501 (5) 46-50	Typ 51	Cat (2) 52-53	Code Ident (5) 54-58	Part or Identifying Number (20) 59-78	80	Sym 31	Nomenclature or Description (48) 32-79	80
		L							1			S1		1		SWITCH, DPDT SLIDE	2
		L							1			S2		1			2
		L												1			2
		L							1			U1	CD4047AE	1		INTEG CKT	2
		L							1			U2	CD4011AE	1			2
		L							1			U3	CD4027AE	1			2
		L							1			U4	CD4047AE	1			2
		L							1			U5	CD4047AE	1			2
		L							1			U6	CD4049AE	1			2
		L							1			U7	CD4047AE	1			2
		L							1			U8	CD4047AE	1			2
		L												1			2
		L												1			2
		L							3				H135R	1		BATTERY MALLORY MERCURY	2
		L							2				182	1		BATTERY HOLDER KEYSTONE	2
		L							1				—	1		BOX 2X3¾X6¼	2
		L							8				—	1		IC SOCKETS	2
		L												1			2
		L												1			2
		L												1			2
		L												1			2
		L												1			2
		L												1			2
		L												1			2
		L												1			2

4 3

DASH NO.	SPECIFICATION TABLE		
	MATERIAL	FINISH	SPECIFICATION
1	AL ALY ANGLE 1.25 x 3.5 x .125	SEE NOTE 1	
2	AL ALY 2024 .125 x 2.00	SEE NOTE 1	
3	AL ALY 2024 .125 x .75	SEE NOTE 1	



NOTES:

1. FINISH - ANODIZE & DYE BLACK

THD DATA TO BE INTERPRETED USING HNDBK H28 AND MIL-STD-9

SECURITY CLASSIFICATION

UNLESS OTHERWISE SPECIFIED THE SURF. FIN. OF MACHINED PARTS SHALL NOT EXCEED A MAX READING OF 125 PER MIL-STD-10

DIMENSIONS AND TOLERANCES PER MIL-STD-8

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING

TOLERANCES ON:		
BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP TO 6	± .02	± .005
ABOVE 6 TO 24	± .03	± .010
ABOVE 24	± .06	± .015

ANGULAR DIMENSIONS ± 1/2°

MATERIAL:

	SSEF
NEXT ASSY	USED ON
FIRST APPLICATION	

FOLDOUT FRAME

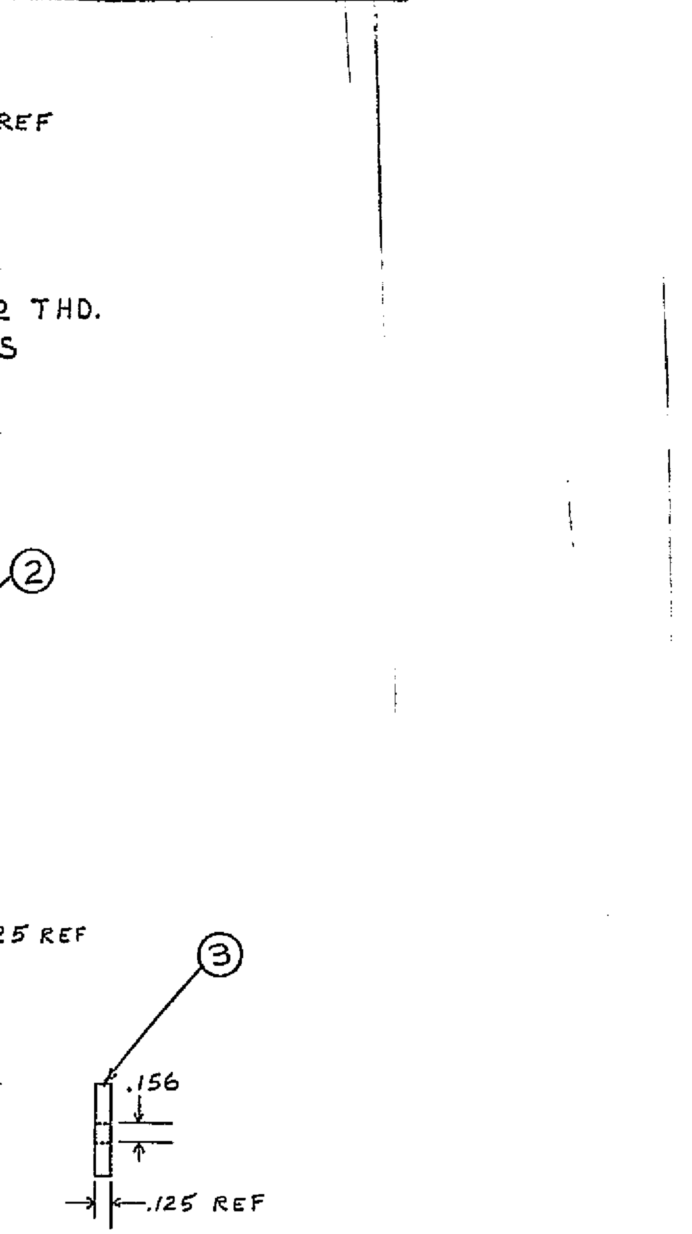
RCA COMMODITY CODE

AED 739-2 3/66

	SPECIFICATION
1	
1	
1	

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

FOR REVISIONS ONLY



FOLDOUT FRAME 2

SKETCH

UNLESS OTHERWISE SPECIFIED THE SURF. FIN. OF MACHINED PARTS SHALL NOT EXCEED A MAX READING OF 125 PER MIL-STD-10

DIMENSIONS AND TOLERANCES PER MIL-STD-8

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING

TOLERANCES ON:		
BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP TO 6	± .02	± .005
ABOVE 6 TO 24	± .03	± .010
ABOVE 24	± .06	± .015

ANGULAR DIMENSIONS ± 1/2°

MATERIAL:

NEXT ASSY	USED ON
	SSEF

FIRST APPLICATION

CONTRACT NO. NAS 9-13549

SHOP ORDER NO.

DRAWN BY B. SOLTOFF DATE 2/24/75

DESIGN ACTIVITY APPD. Bertram Soltoff DATE 2/25/75

RADIO CORPORATION OF AMERICA
NEW YORK, N.Y.
ASTRO-ELECTRONICS DIVISION, PRINCETON, N.J., PLANT

POLARIZING FILTER CLAMPS

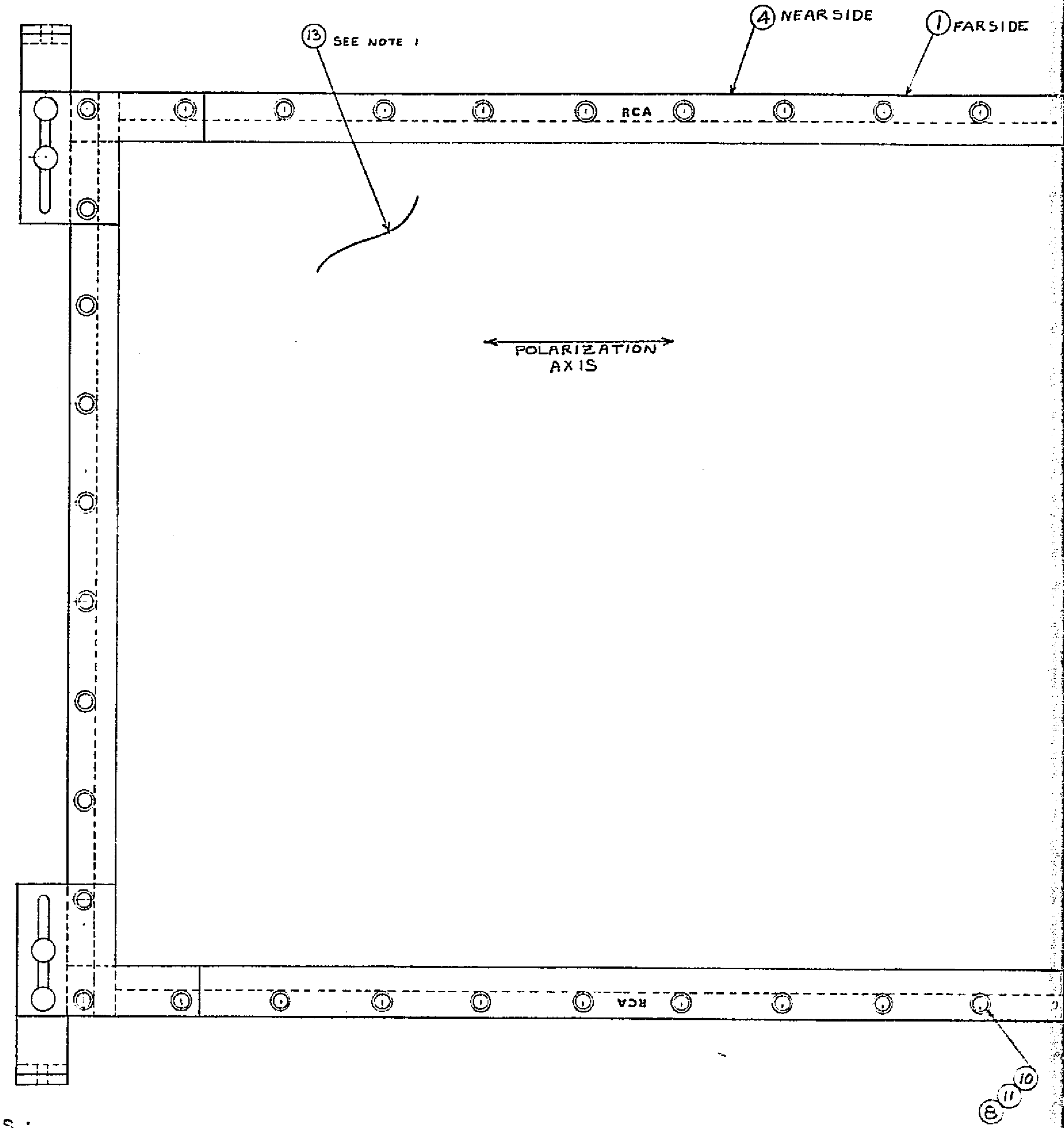
SIZE	CODE IDENT NO.	
C	49671	SK 2282706

SCALE 1/1 WEIGHT — SHEET 1 OF 1

LTR SK 2282706

8	7	6	5

SPECIFICATION TABLE		
MATERIAL	FINISH	SPECIFICATION



NOTES:

1. CUT ITEM 1 TO SIZE (16.25 x 13.25), WITH POLARIZATION AXIS HORIZONTAL.

THE DATA TO BE INTERPRETED USING INDEX H28 AND MIL-STD 9	SECURITY CLASS
RCA COMMODITY CODE	

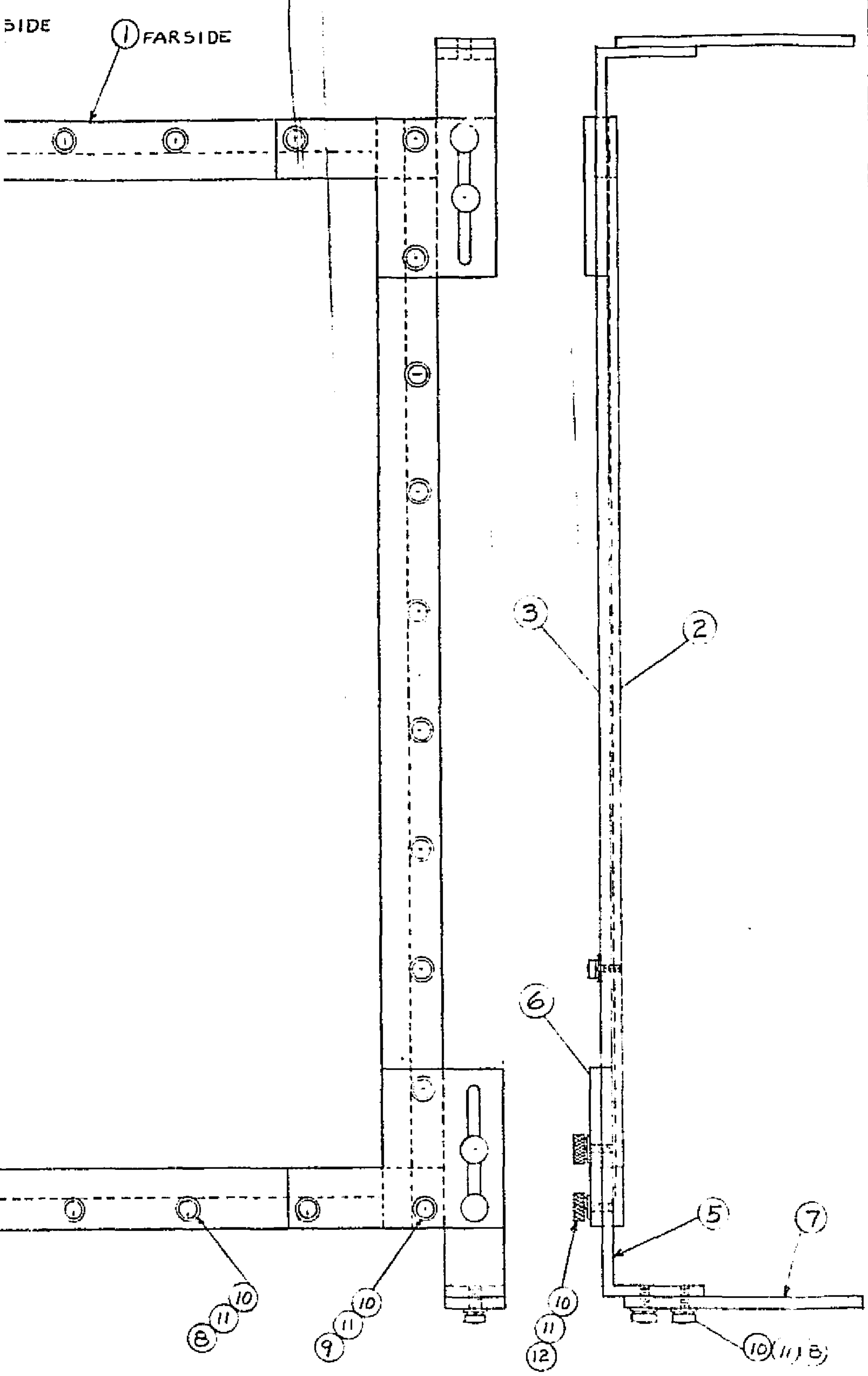
OUT FRAME /

739-3 3/46

4 3 2 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

FOR REVISIONS ONLY



FOLDOUT FRAME 2

FOR PARTS LIST SEE PL SK 2288064

SKETCH

TO BE INTERPRETED USING ... AND MIL-STD-9

SECURITY CLASSIFICATION

UNLESS OTHERWISE SPECIFIED THE SURF. FIN. OF MACHINED PARTS SHALL NOT EXCEED A MAX READING OF 125 PER MIL STD 10

DIMENSIONS AND TOLERANCES PER MIL-STD-8

NEXT ASSY	USED ON
FIRST APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING

TOLERANCES ON		
BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP TO 6	± .02	± .005
ABOVE 6 TO 24	± .03	± .010
ABOVE 24	± .06	± .015

ANGULAR DIMENSIONS ± 1/2°

MATERIAL:

...ODITY CODE

CONTRACT NO. [illegible] 1-13338

SHOP ORDER NO.

DRAWN BY [illegible] DATE 2/21/75

DESIGN ACTIVITY APPD [illegible] DATE 2/26/75

RADIO CORPORATION OF AMERICA
NEW YORK, N.Y.
ASTRO-ELECTRONICS DIVISION, PRINCETON, N.J. PLANT

POLARIZING FILTER ASSEMBLY

SIZE	CODE IDENT NO.	
D	49671	SK 2288064

SCALE 1/1 WEIGHT 1.5 LBS. SHEET 1 of 1

PARTS LIST	RCA — RCA CORPORATION I NEW YORK, NY — ASTRO-ELECTRONICS DIVISION, PRINCETON, N.J	REVISION DATE	PLSK2288064	REV LTR

LIST TITLE: POLARIZING FILTER	PREPARED BY / DATE	REL	CODE IDENT NO. 49671	SHEET 1 OF 2 SHEETS
	CHECKED BY / DATE		CONTRACT NO. NAS 9-13688	
	DESIGN ACTIVITY APPD / DATE: [illegible signature] 2/26/75			

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED	LTR	DESCRIPTION	DATE	APPROVED

INTERPRET SYMBOLS USED AS FOLLOWS:

UNITS OF MEASURE (UM)	QUANTITIES	SYMBOL
A — Inches; B — Feet; C — Yards; D — Ounces; E — Pints; F — Quarts; G — Gallons; H — Barrels; J — Pounds; L — Pair; M — Set; N — Kit; P — Roll; R — Box, Case; T — Each	X — Applicable document; O — For ref only	U — Govt or customer furnished; K — Govt or customer furnished and installed; ✲ — Vendor item, See specification or source control drawing.

RCA 2400-3 (8-68) 1107

Parts List Worksheet

RCA Astro Electronics

Next Higher Assembly No. —
Shop Order
Contract NAS9-13698

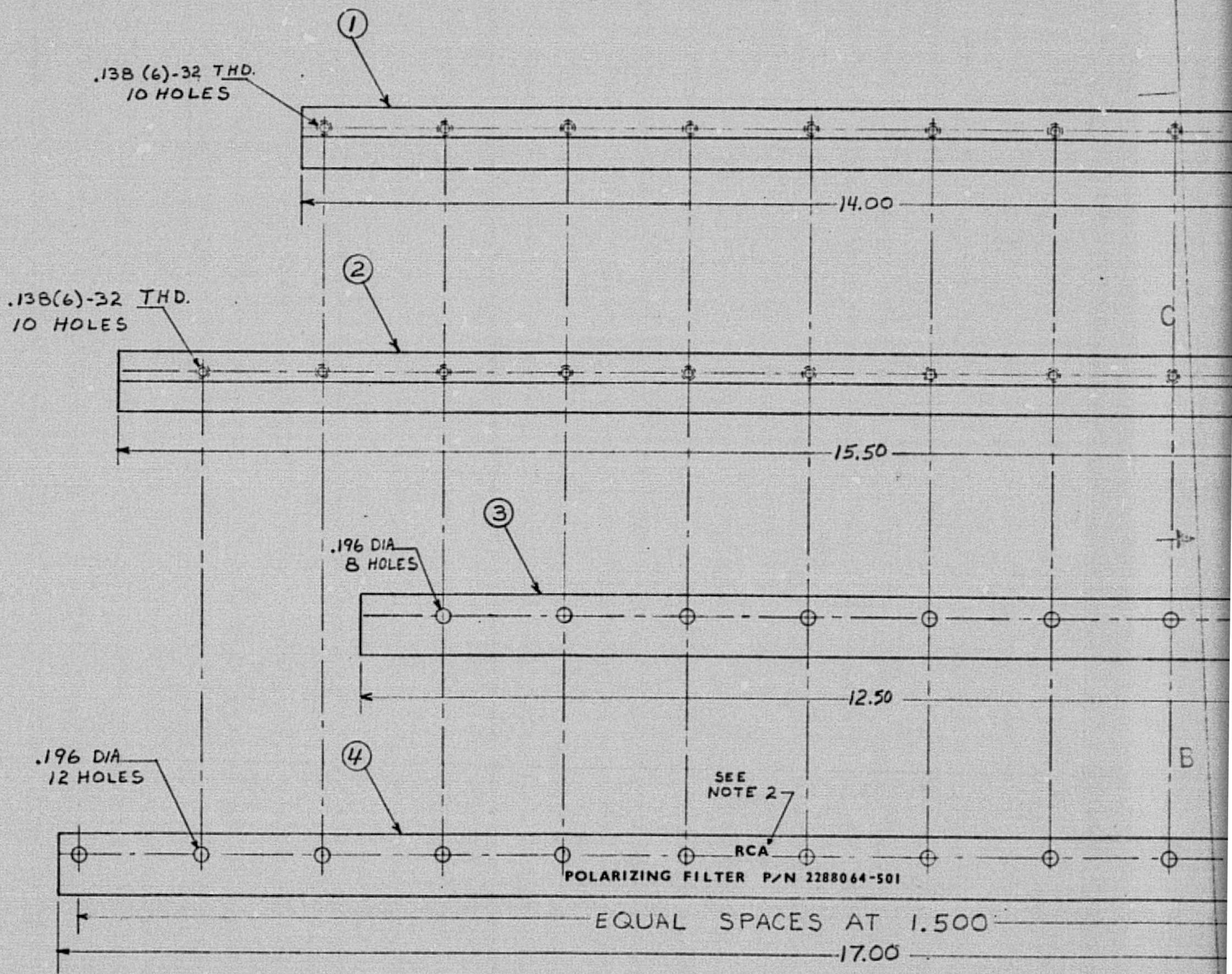
Project SSEF
Prepared by
Checked by
Date
Date

Assembly Number 1–14	P G 15	16–19	20	Rev 21–22	23	24	25	26–30	Shop Order 31–39	Assembly Title 40–58	PL Number 59–69	70	H.G. 71-72	Dup 73-74	75	Z 76	77–79	80
SK 2288064			H				1			POLARIZING FILTER	PLSK 2288064							1

H.G. (2) 16-17	Suf (2) 18-19	20	24	25	Item No (5) 26-30	Quantity Required 504 (5) 31-35	503 (5) 36-40	502 (5) 41-45	501 (5) 46-50	Type 51	UM (2) 52-53	Code Ident (5) 54-58	Part or Identifying Number (20) –78	80	CAS 31	Nomenclature or Description (48) 32–79	80
		L			1				2				2288065-1	1		POLARIZING FILTER FRAME	2
		L			2				2				2288065-2	1			2
		L			3				2				2288065-3	1			2
		L			4				2				2288065-4	1			2
		L			5				4				2282706-1	1		POLARIZING FILTER CLAMPS	2
		L			6				4				2282706-2	1			2
		L			7				4				2282706-3	1			2
		L			8				36				NAS 1635-06-5	1		SCREW, MACHINE	2
		L			9				12				NAS 1635-06-7	1		SCREW, MACHINE	2
		L			10				56				8924401-4	1		WASHER, FLAT	2
		L			11				56				NAS 1640-6	1		WASHER, LOCK	2
		L			12				8			00141	4018	1		THUMB SCREW, KNURLED	2
		L			13				1			97197	70420	1		POLARIZING SHEET	2
		L												1			2
		L												1			2
		L												1			2
		L												1			2
		L												1			2
		L												1			2
		L												1			2
		L												1			2
		L												1			2
		L												1			2
		L												1			2
		L												1			2

AEO 578 7/71

DASH NO.	SPECIFICATION TABLE MATERIAL	FINISH	SPECIFICATION
1,2, 3,4	AL ALY 2024 ▱ .125 x .75	SEE NOTE 1	

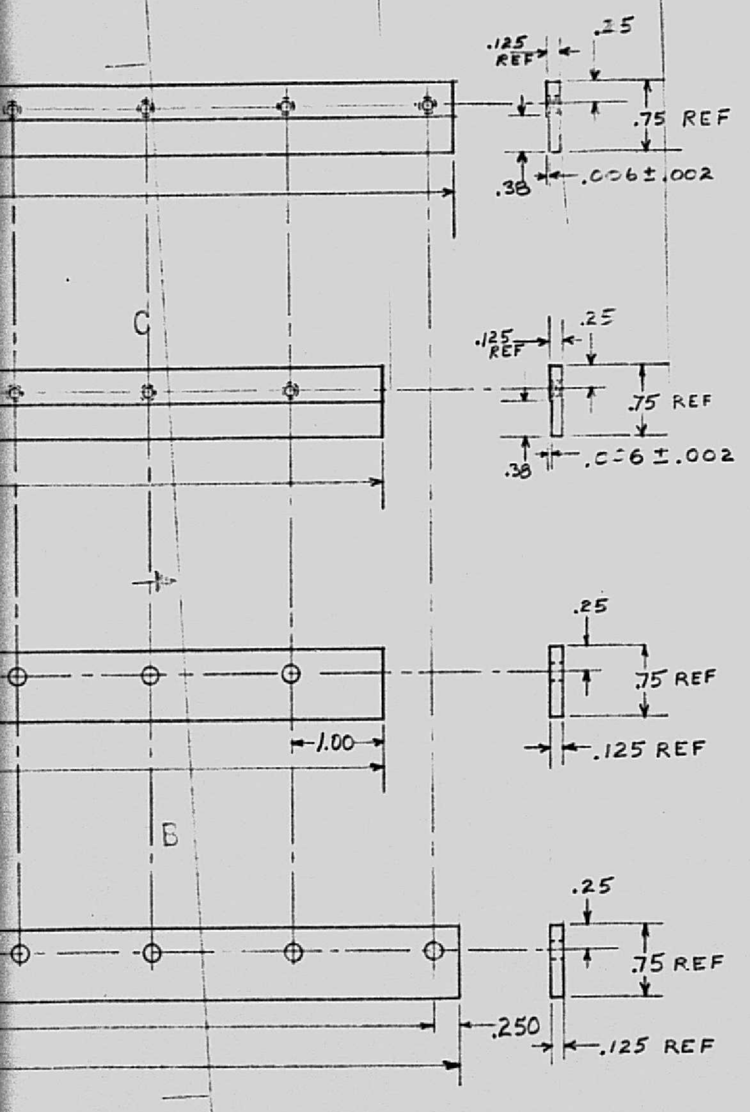


NOTES:

1. FINISH – ANODIZE & DYE BLACK
2. MARK WITH .12 CHARACTERS (WHITE EPOXY) IN APPROXIMATE LOCATION SHOWN

THD DATA TO BE INTERPRETED USING HNDBK H28 AND MIL-STD-9
RCA COMMODITY CODE

FOLDOUT FRAME 1



FOR REVISIONS ONLY

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

FOLDOUT FRAME 2

SKETCH

BE INTERPRETED USING
D MIL-STD-9

SECURITY CLASSIFICATION

UNLESS OTHERWISE SPECIFIED THE SURF. FIN. OF MACHINED PARTS SHALL NOT EXCEED A MAX READING OF 125 PER MIL-STD-10

DIMENSIONS AND TOLERANCES PER MIL-STD-8

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE THICKNESS OF PLATING

TOLERANCES ON:		
BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP TO 6	± .02	± .005
ABOVE 6 TO 24	± .03	± .010
ABOVE 24	± .06	± .015

ANGULAR DIMENSIONS ± 1/2°

MATERIAL:

SSEF	
NEXT ASSY	USED ON
FIRST APPLICATION	

TY CODE

CONTRACT NO. NAS 9-13688

SHOP ORDER NO.

DRAWN BY BERT SOLTOFF DATE 2/21/75

DESIGN ACTIVITY APPD. Bertm Soltoff DATE 2/26/75

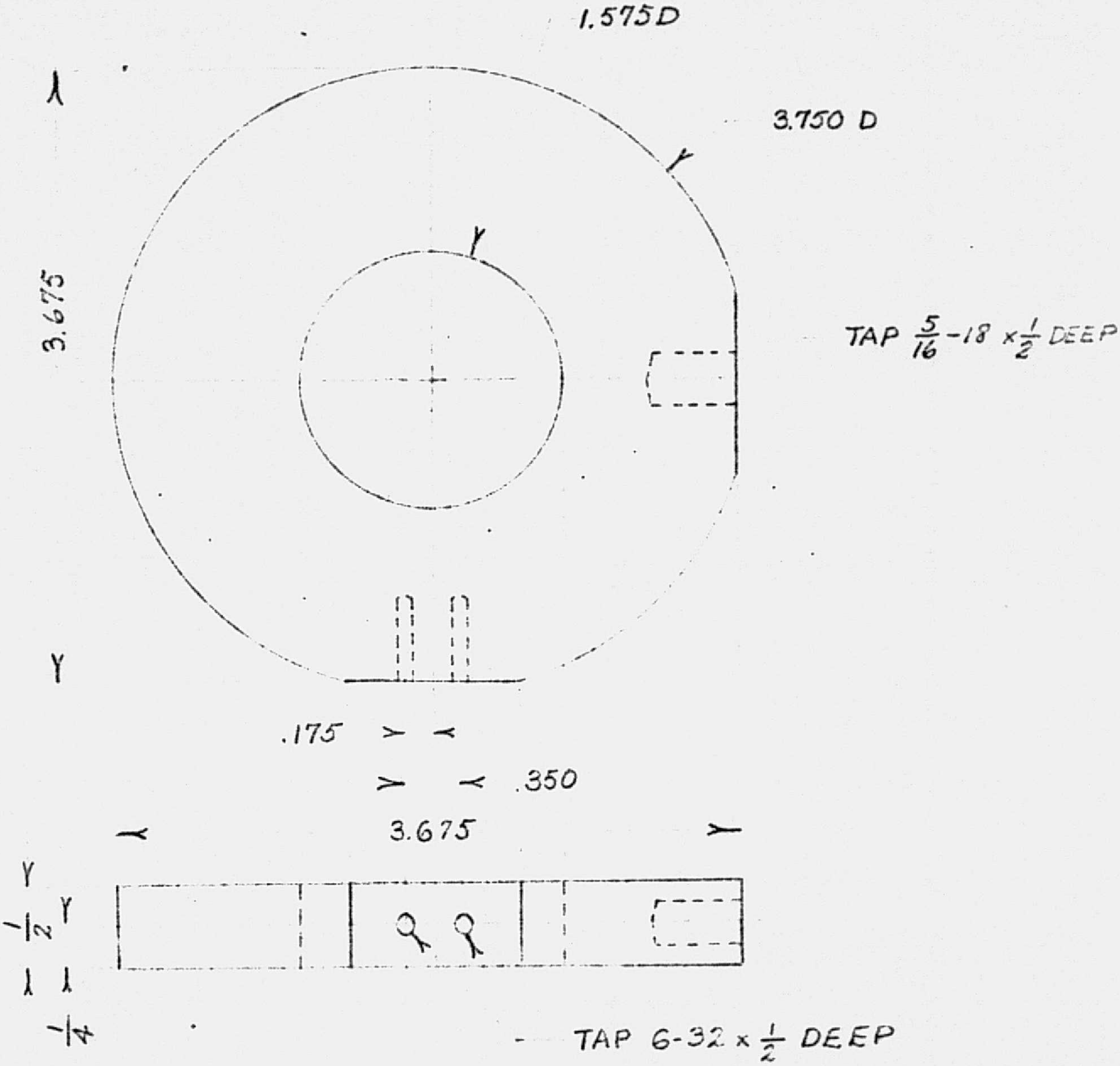
RADIO CORPORATION OF AMERICA
NEW YORK, N.Y.
ASTRO-ELECTRONICS DIVISION, PRINCETON, N.J., PLANT

POLARIZING FILTER FRAME

SIZE	CODE IDENT NO.	
D	49671	SK 2288065

SCALE 1/1 WEIGHT — SHEET 1 OF 1

SK 2288065



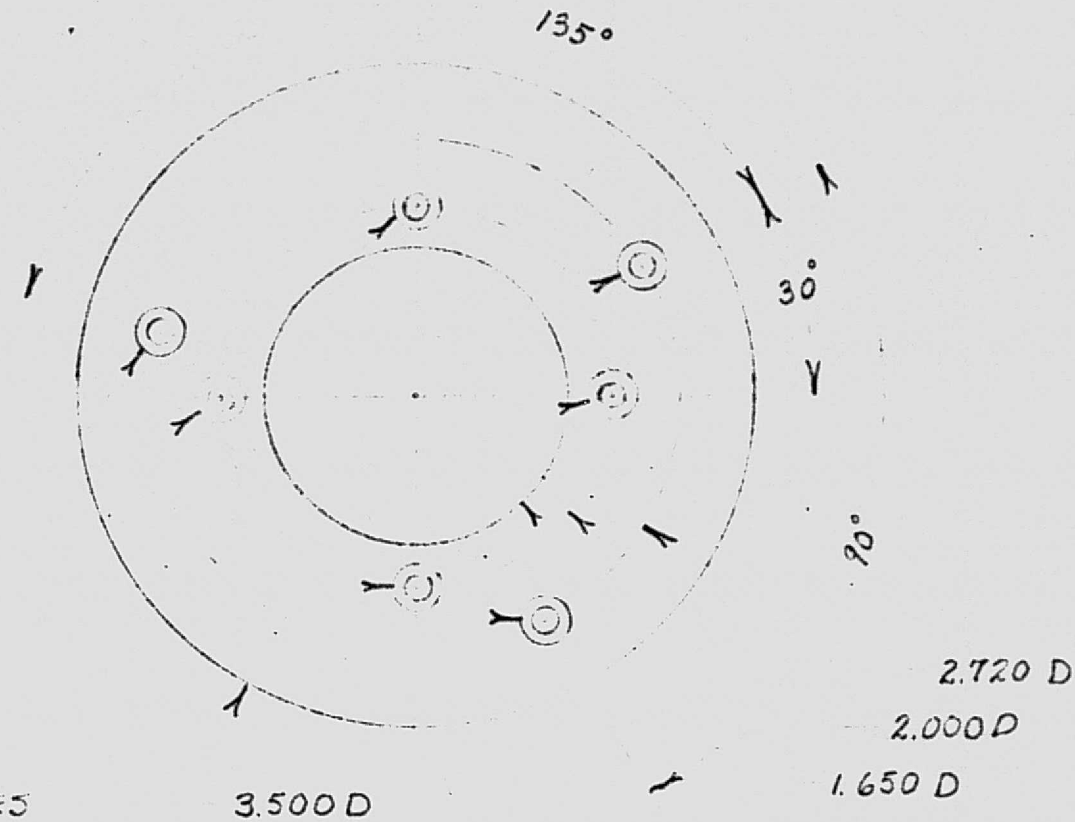
PART A 3 REQUIRED
MAKE FROM 1/2 INCH ALUMINUM.

ALL DIMENSIONS IN INCHES.

FRACTIONAL DIMENSIONS ±1/64 TOLERANCE.
DECIMAL DIMENSIONS ±.002 TOLERANCE.

BLIND TAPS NEED NOT BE WELL-BOTTOMED.

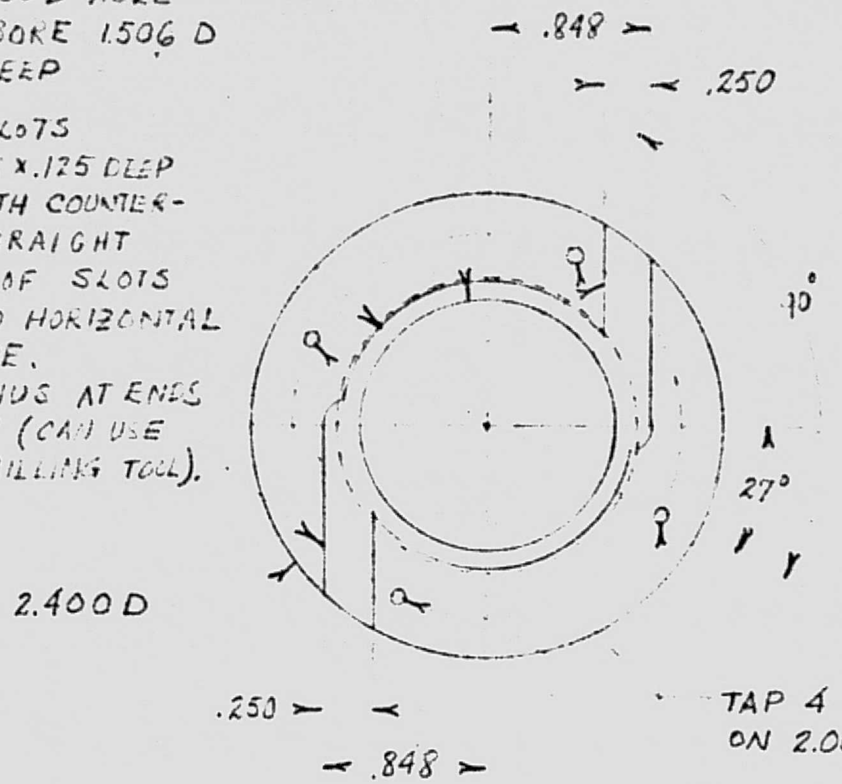
AM12875-1 ARTHUR MILLER x2056 E-217 S.O.# 07-15555



DRILL 7 HOLES
.1440 D AND
COUNTERSINK FOR 6-32 FLAT HEAD SCREWS

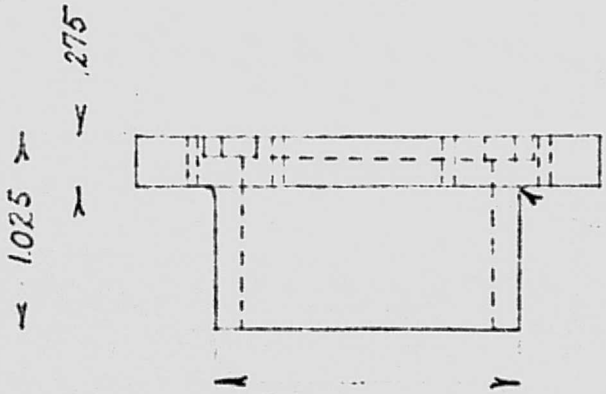
PART B. 3 REQUIRED
MAKE FROM $\frac{1}{8}$ THICK ALUMINUM
ALL DIMENSIONS IN INCHES ±.002 TOLERANCE

1. BORE 1.300 D HOLE
2. COUNTERBORE 1.506 D × .125 DEEP
3. MILL 2 SLOTS .250 WIDE × .125 DEEP (FLUSH WITH COUNTERBORE). STRAIGHT PORTIONS OF SLOTS EXTEND TO HORIZONTAL CENTERLINE. .125 RADIUS AT ENDS OF SLOTS (CAN USE .250 D MILLING TOOL).



TAP 4 HOLES 6-32 ON 2.000 DIAMETER CIRCLE

ORIGINAL PAGE IS OF POOR QUALITY



.035 RADIUS OR LESS IS OKAY.

THIS DIAMETER SHOULD BE SUCH THAT PIECE FITS INTO 1.575 D HOLE IN PART A (DWG. AM 12875-1) WITHOUT EXCESSIVE PLAY, AND ROTATES SMOOTHLY

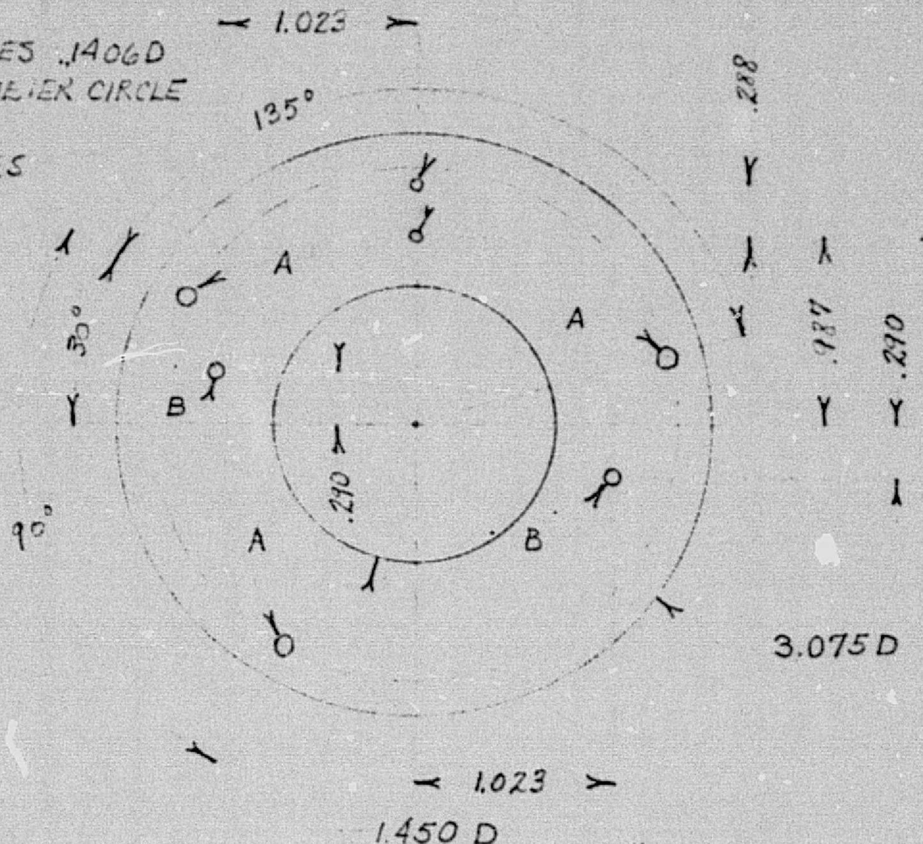
PART C. 3 REQUIRED. MAKE FROM TEFLON
ALL DIMENSIONS IN INCHES. ±.002 TOLERANCE

AM 12875-3 ARTHUR MILLER ×2056 E-217 SO #07-155550

TAP 2 HOLES 2-56

A. DRILL 3 HOLES .1406 D
ON 2.720 DIAMETER CIRCLE

B DRILL 2 HOLES
.0890 D

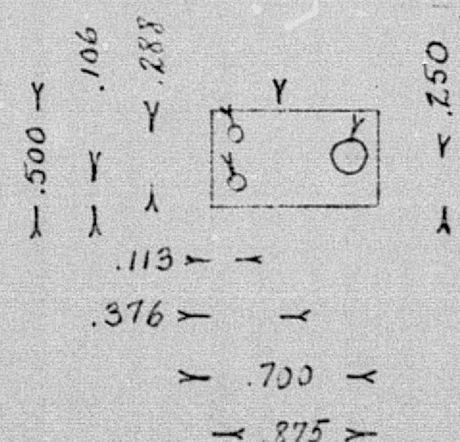


PART D. 3 REQUIRED. MAKE FROM $\frac{1}{4}$" THICK LUCITE OR PLEXIGLASS

BEND LINE: MAKE 90° BEND AT THIS LINE.
RADIUS LEFT BY BENDING BRAKE IS OKAY.

DRILL 2 HOLES .0890 D

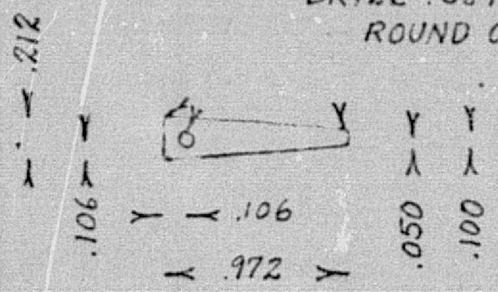
DRILL .1910 D



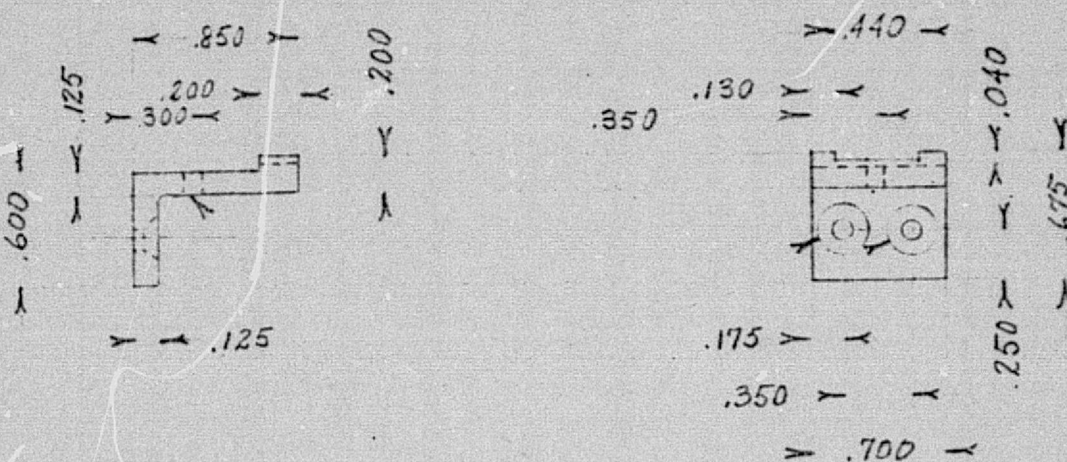
PART E. 3 REQUIRED
MAKE FROM $\frac{1}{16}$" THICK BRASS
TO BE GOLD PLATED

ALL DIMENSIONS IN INCHES. ± .002 TOLERANCE

DRILL .0890D
ROUND OFF CORNERS, AS SHOWN, WITH FILE



PART F. 6 REQUIRED. MAKE FROM .005" THICK BERYLLIUM-COPPER OR PHOSPHOR BRONZE. TO BE GOLD PLATED.

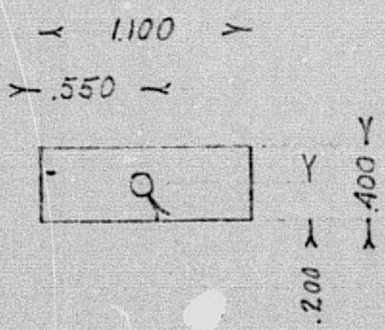


DRILL 2 HOLES .1440 D AND
COUNTERSINK FOR 6-32 FLAT HEAD SCREWS

TAP 6-32

PART G. 3 REQUIRED. MAKE FROM ALUMINUM

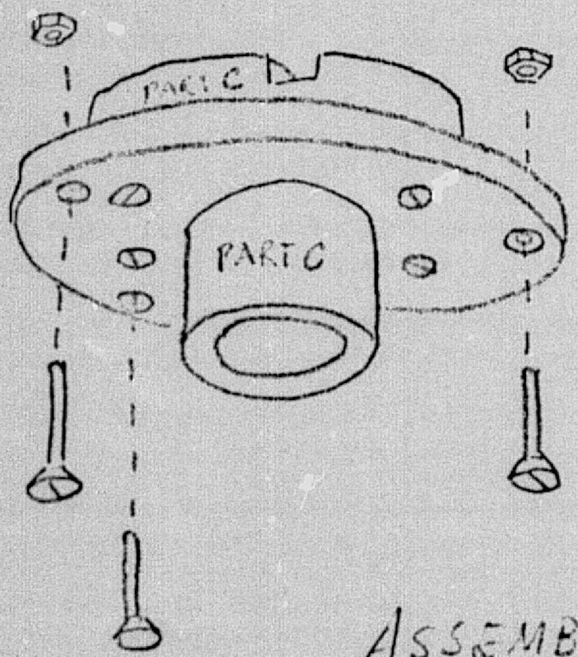
PART H. 3 REQUIRED
MAKE FROM $\frac{1}{8}$" THICK ALUMINUM

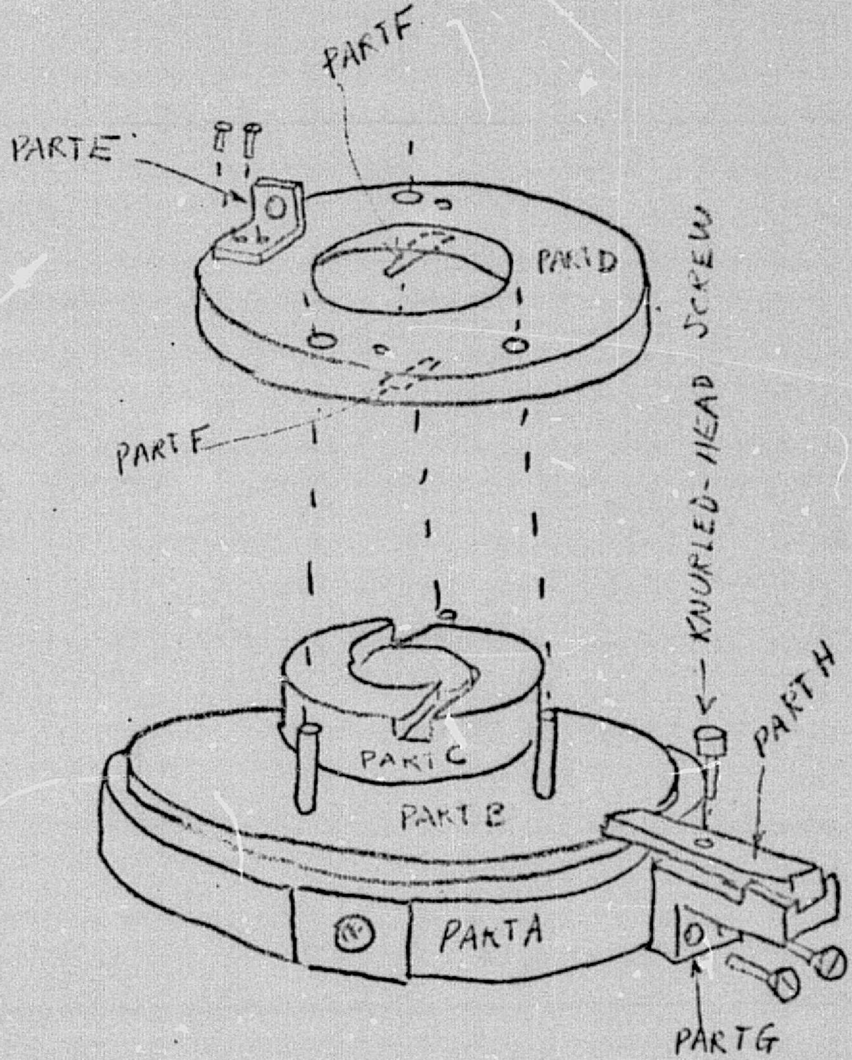


DRILL .1520 D

ALL DIMENSIONS IN INCHES, ±.002 TOLERANCE

AM12875-5 ARTHUR MILLER X2056 E-217 S.O.# 07-155550





ASSEMBLY SCHEME - FOR REFERENCE ONLY
NOT TO SCALE

AM12875-6 ARTHUR MILLER X2056 E-317 S.O. # 07-10550